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AN OFFICIAL REPORT ON

JAPAN'S AIR FORCES

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Rugged Addition to a *Flying Family*

Like the heredity of generations passed on to new life in the wilds, three models of Cyclones with over *one hundred million* hours of operation form the background of the newest engine in the Wright series: the Cyclone 7.

This engine, rated initially at 700 horsepower, combines the best features evolved in 20 years of Cyclone experience. It was designed specifically for short-range military aircraft—trainers, cargo carriers and transports—and for feeder lines and utility planes.

The Cyclone 7 features economy. It is rugged, reliable, powerful. It saves fuel costs by using low octane fuel. It saves parts inventories by interchangeability with other Cyclones. It cuts overhaul and maintenance costs by long service life. Combining durable power with operating economy, the Cyclone 7 is an engine which will make possible a new type of air transportation.

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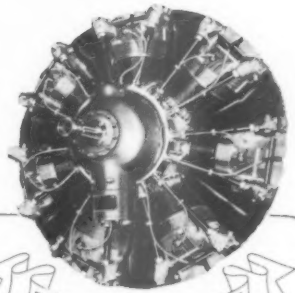
Wright Aeronautical Corporation *Paterson, New Jersey, U. S. A.*



The New CYCLONE 7

A seven-cylinder engine combining Cyclone features proved in service. Distinctive points include:

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Exceptional Cooling
Two-speed Supercharger
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Aluminum Finned Barrels

FLYING

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WILLIAM B. ZIFF
Editor and Publisher

B. G. DAVIS
General Manager

MICHAEL H. FROELICH
Assistant to the Publisher

MAX KARANT
Managing Editor

CURTIS FULLER
Assistant Managing Editor

Associate Editors

CHICAGO
Paul Fountain, Lawrence Keil

WASHINGTON
Fred Hamlin, F. D. Walker

LOS ANGELES
Gaither Littrell

NEW YORK
William C. Hoff

Art Editor: Lew Merrell

Staff Photographers: Frank Ross, Arthur Haug

HERMAN R. BOLLIN
Art Director

GEORGE BERNER
Advertising Director

H. G. STRONG
Circulation Director

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Production Director

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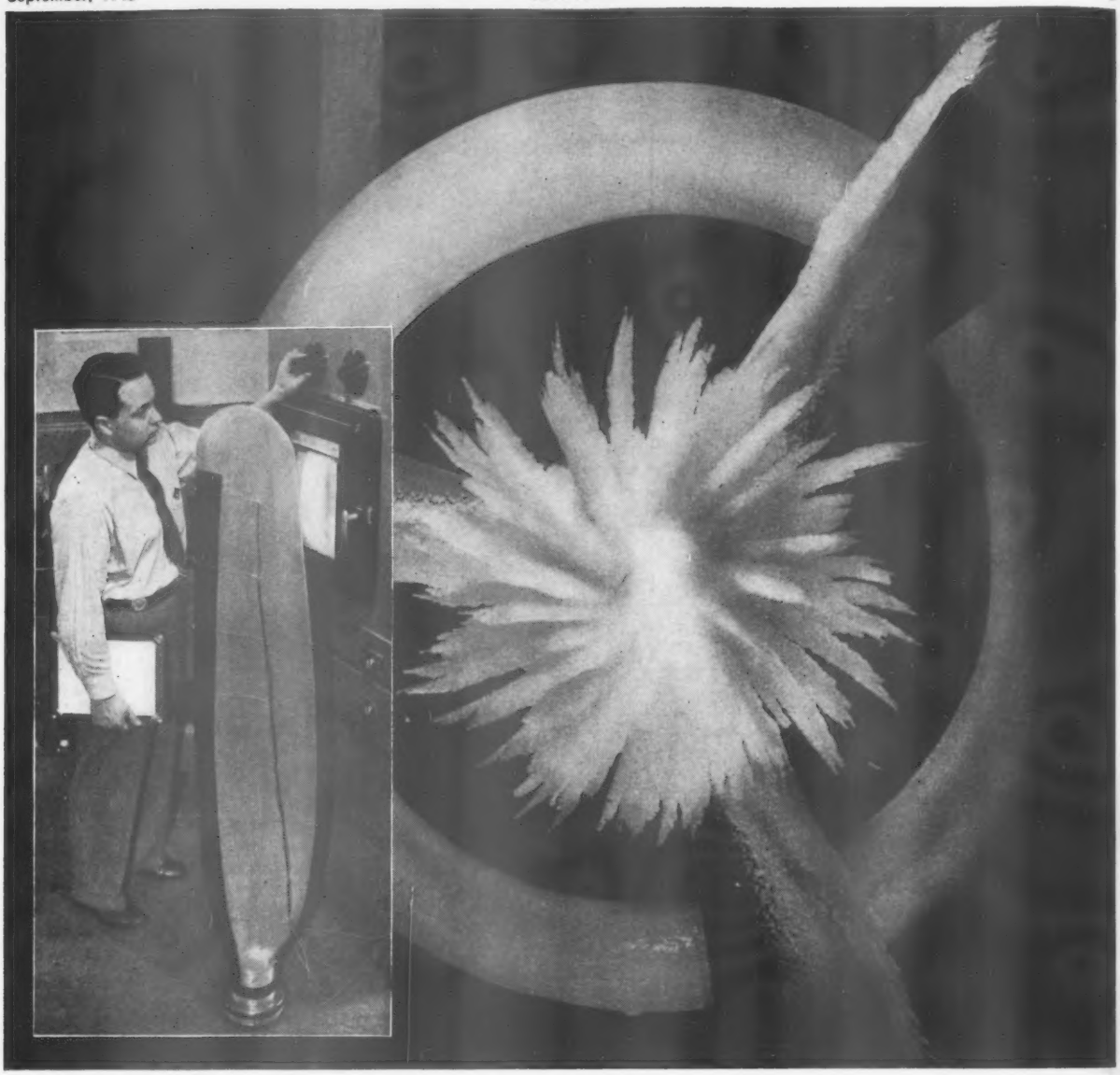


Hot shoes for cold propellers

THE ICE FLOWER on the hub of this model airplane propeller isn't as serious as it looks; but fingers of ice, creeping along the blades, were a big worry to pilots for years. The picture was made in a B. F. Goodrich refrigerated wind tunnel in an 80-mile-an-hour wind, which exaggerates the hub ice. But ice on the blades, in actual flight, means loss of power, bad balance, vibration that could even jar the engine loose.

To a pilot, the smaller picture looks a lot better. It's an electrically heated propeller shoe, a new B. F. Goodrich development. It's shown here hooked up to a testing machine in the laboratory. (The wires are part of the testing equipment; they are not on the blade in flight.)

With these shoes on his propeller blades, the pilot simply flicks a switch when he runs into icing weather. Current flows through wires along the shoes' edges. A special conductive rubber carries the current across the shoe, and carefully planned resistances cause the rubber to heat up.

Many other airplane parts need ice protection, too . . . and B. F. Goodrich makes equipment to do the *whole* job. The B. F. Goodrich De-Icer, for instance, cracks ice off as it forms on wings and tails, keeping these surfaces clean and smooth for safer flying.

Years of ice-fighting experience are back of this equipment. It means a safer, more comfortable trip if you fly today or when you fly tomorrow. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

Bombs from Martin Marauders helped to close the books on Germany.

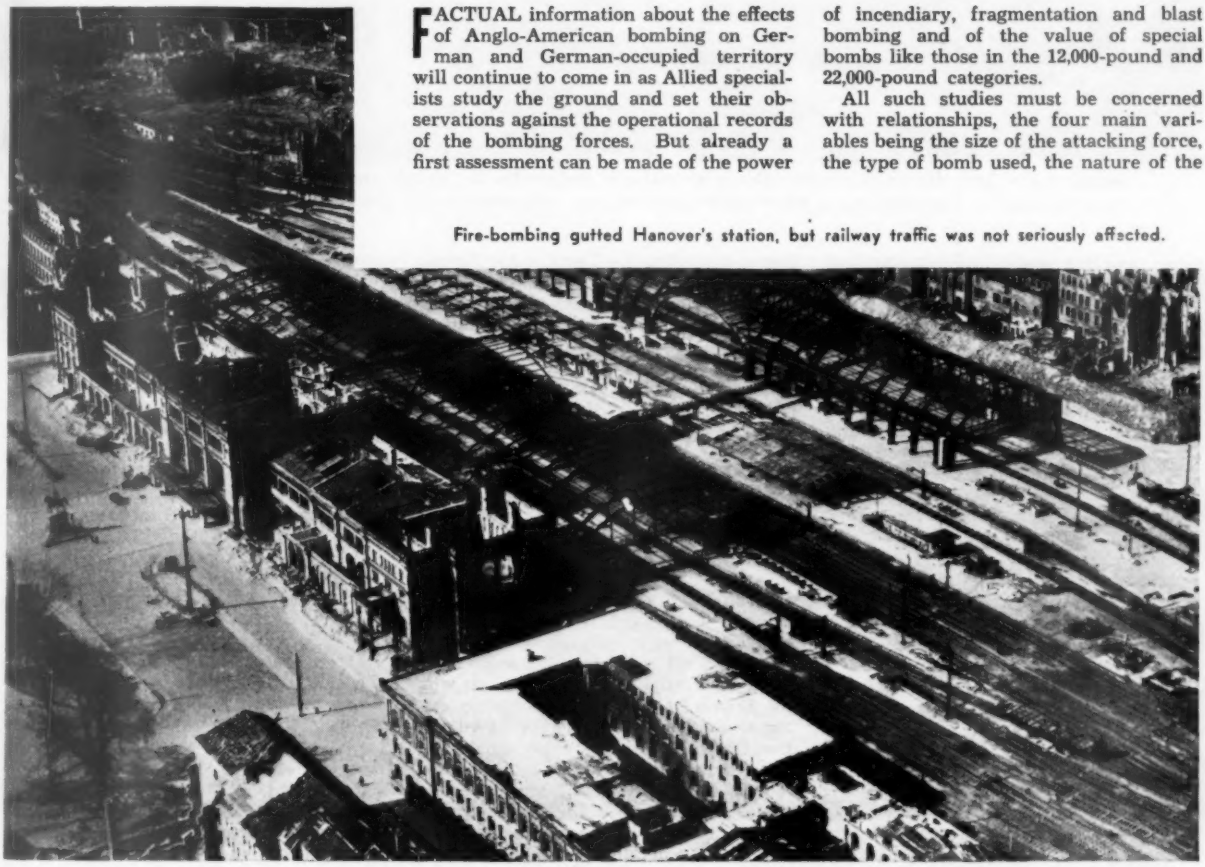
BOMBING BALANCE SHEET

By Maj. OLIVER STEWART
Editor of Aeronautics

British analyst compares bombing theories, methods and tonnage used in European war.

FACTUAL information about the effects of Anglo-American bombing on German and German-occupied territory will continue to come in as Allied specialists study the ground and set their observations against the operational records of the bombing forces. But already a first assessment can be made of the power of incendiary, fragmentation and blast bombing and of the value of special bombs like those in the 12,000-pound and 22,000-pound categories.

All such studies must be concerned with relationships, the four main variables being the size of the attacking force, the type of bomb used, the nature of the



Fire-bombing gutted Hanover's station, but railway traffic was not seriously affected.

Despite use of both demolition charges (oblong craters) and medium bombs (circular craters), much of Langenhagen's runways remained useable. Even hangars and administration buildings were not completely destroyed by the concentrated bombing attacks.

target and the method of sighting and releasing the bombs.

It is almost useless to discuss any one of these variables without the others. Therefore no rational examination of Allied bombing results was possible until the Germans had surrendered and Allied specialists had visited the target areas. In the following remarks I use Air Ministry information plus data collected for me by two experienced observers who made a tour of northwest Germany.

I propose first to tabulate the official figures for the total bomb loads released. The tonnages are in long tons (one ton equals 2,240 pounds). I then propose to refer to target selection and to the bombs, sights and methods employed for some of the more important attacks.

SIX YEARS OF BOMBING

	RAF	USAAF
1940	13,000 long tons	.....
1941	32,000 long tons	.....
1942	45,500 long tons	1,500 long tons
1943	157,000 long tons	48,500 long tons
1944	547,000 long tons	578,500 long tons
1945	191,000 long tons	263,000 long tons
Total	986,000 long tons	891,500 long tons

In the whole of the war in Western Europe the British and American air forces, excluding the Tactical Air Forces, dropped 1,877,500 long tons.

In the welter of statistics it is important to distinguish between the headings used. In the above table Royal Air Force Bomber Command and the RAF component of the Allied Air Forces in Italy are both included. Under the heading "USAAF" are included the 8th United States Air Force based on England and the 15th based on Italy.

Two points should be noted: first, it was not until the German bombing of Britain had been controlled (a result of the RAF Fighter Command victory in the Battle of Britain and the improvement in radar night location and fighting devices) that the RAF bomb loads began to increase rapidly; second, the rate of bomb loads was increasing much more rapidly with the United States than with the British forces. This was mainly owing to the greater productive powers of the United States but also partly because British production was to some extent hampered throughout by the need to disperse factories, to put some underground, to erect blast walls in the workshops and generally to take precautions against the threat of enemy bombing.

Another point to be noted is that it was customary for the RAF to name a city as having been attacked when the chief targets, industrial plants, stores, railway marshalling yards and the like, were *in* that city. The USAAF, on the other hand, named only specific targets.

The consequence is that truly comparable figures for the "biggest" bombing attacks cannot be given. All that can be done is to quote some of the heaviest RAF attacks and refer to exceptionally large operations by the USAAF.

Here are two groups of bombing attacks by the RAF Bomber Command:

BOMBER COMMAND ATTACKS

Date	Place	Weight
	HIGH EXPLOSIVE	
June 6, 1944	10 Normandy coastal batteries	About 5,000 tons
October 14, 1944	Duisburg	Over 4,500 tons
March 11, 1945	Essen	About 5,000 tons
March 12, 1945	Dortmund	About 5,000 tons
	INCENDIARY	
		Number
February 13, 1945	Dresden	650,000
February 14, 1945	Chemnitz	730,000
March 7, 1945	Dessau	500,000

The weights or numbers of bombs dropped and the dates are noteworthy.

(*Continued on page* 100)

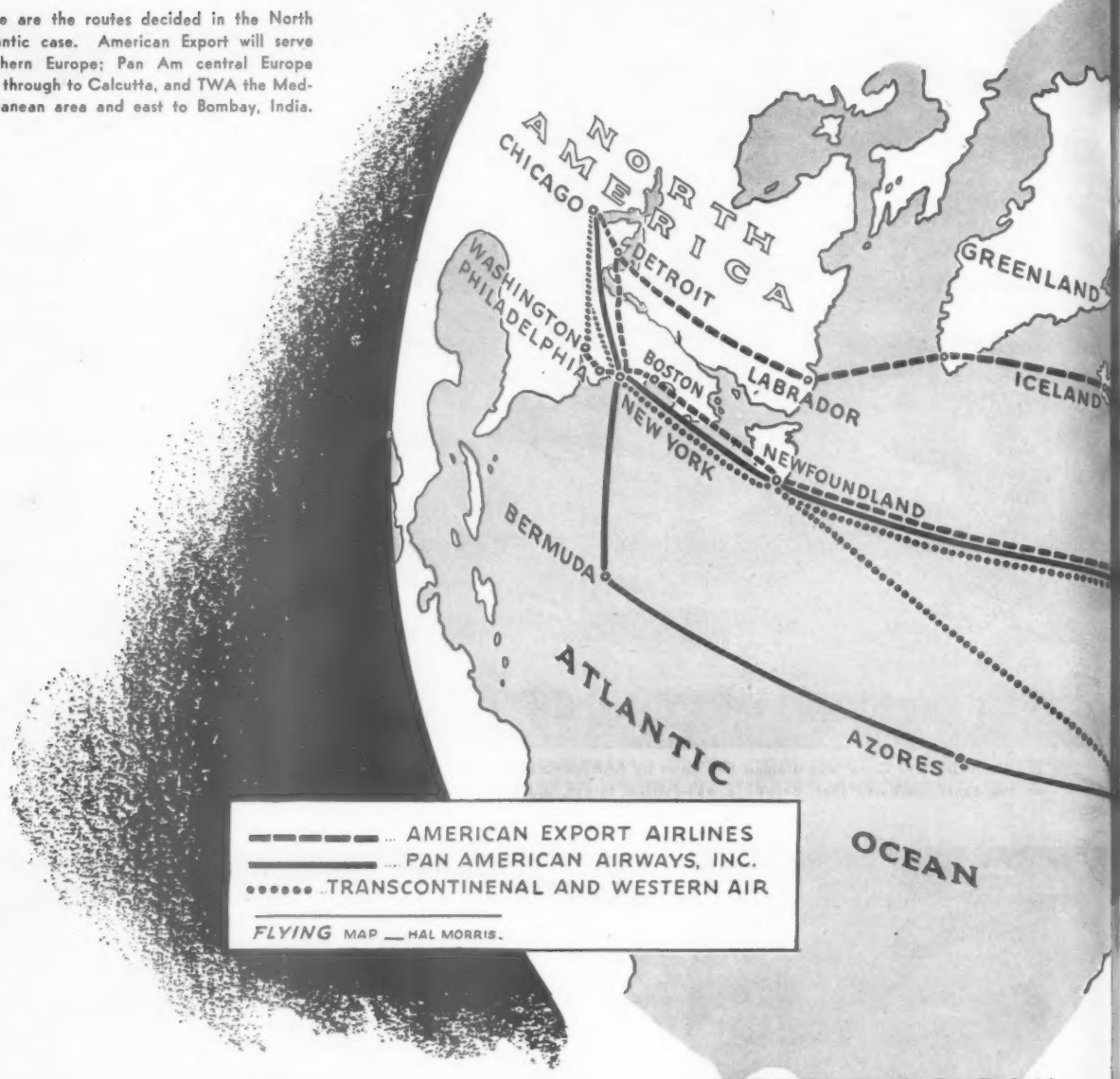
The Dortmund-Ems Canal was drained five times by RAF bombing attacks. Note that drainage was effected only by direct hits on the canal itself and that, despite a well-defined target, much of total bomb tonnage was expended on non-vital areas.

One 8,000-pound package of the nearly two million tons of high explosives rained on Germany.

Even the heavily reenforced E-boat pens at Le Havre could not withstand Allied bombings, but it took a 12,000-pounder to pierce ferro-concrete roof of this one.

Decision in

Here are the routes decided in the North Atlantic case. American Export will serve northern Europe; Pan Am central Europe and through to Calcutta, and TWA the Mediterranean area and east to Bombay, India.



By

FRANKLIN D. WALKER

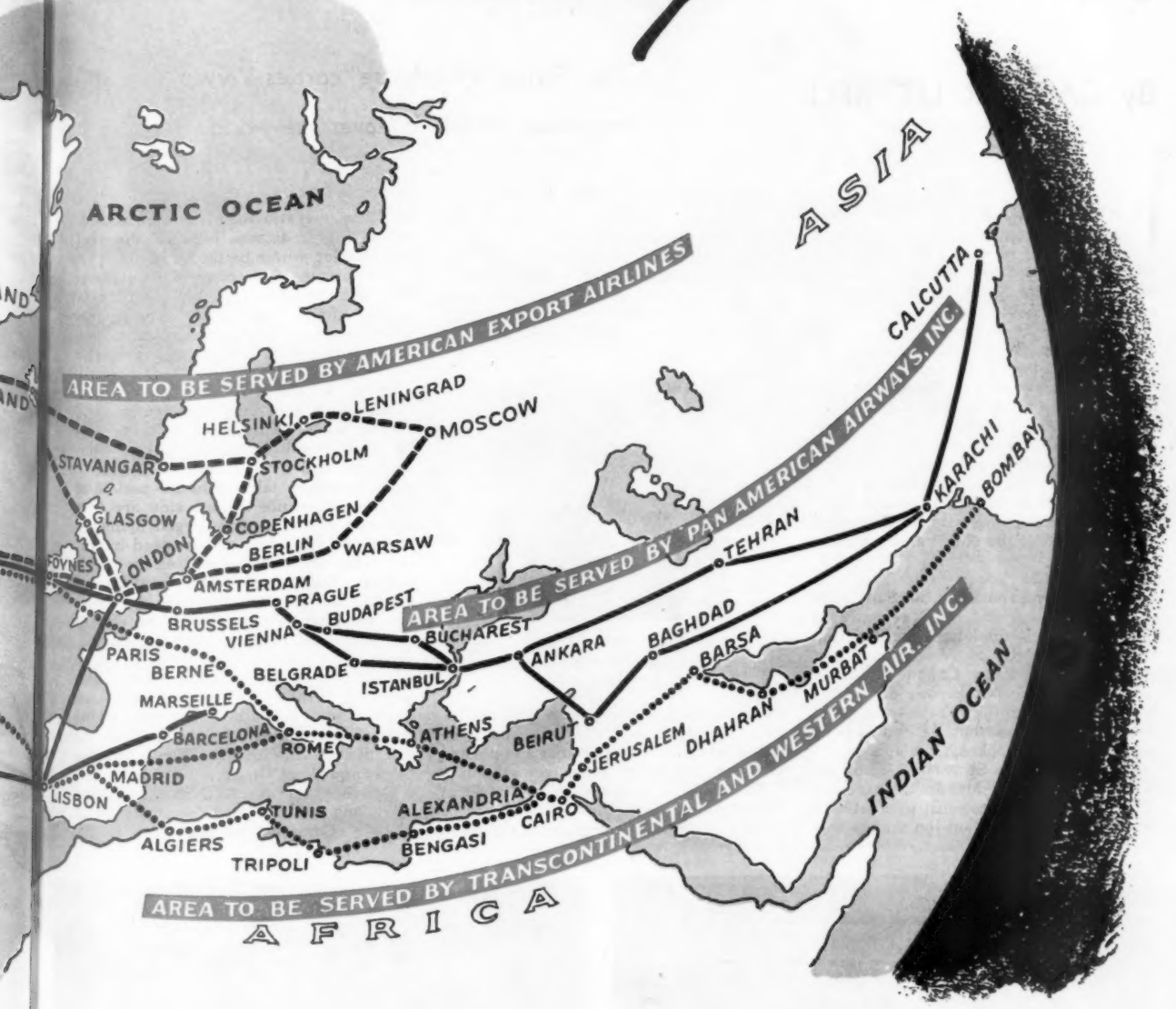
Associate Editor of FLYING, Washington

The CAB has decided: regulated competition on an area basis will keynote our international air operations.

THE Civil Aeronautics Board's decision authorizing TWA, American Export and Pan American Airways to operate intercontinental routes across the North Atlantic was not, as many presumed, an original statement of U. S. International air policy. That policy was clearly set forth in the Civil Aeronautics Act of 1938 and is, simply, one that fosters competition necessary to assure sound development of our foreign and domestic commerce in the air.

The significance of the Board's opinion lies in its approach to and solution of this basic question: Should the national policy of regulated competition in air commerce be abandoned for a policy of monopoly in

Air Policy



the international air transportation field?

Adhering to the provisions of the law it was created to administer, the Board decided in favor of regulated competition as against a single American flag line or so-called "chosen instrument." The Board virtually stated that the policy of regulated competition, rather than of monopoly, will be pursued wherever possible in its review of applications pending for routes across the South Atlantic and the Pacific, and to other continental areas. The Board's words were:

"The North Atlantic trade route is admittedly one of the best international traffic routes. In view of the fact that Pan American (including Panagra) is the only air carrier holding permanent certificates authorizing international air transportation and is presently authorized to conduct its operations into all major parts of the world, a decision here that only one air carrier is required across the North Atlantic would in effect constitute a finding that only one United States air carrier should be authorized to engage in international air service."

No sooner had this policy been stated than it was implemented a few days later by a new decision which granted United Air Lines a certificate to operate between San Francisco and Honolulu. Paradoxically, United Air Lines had opposed the regulated competition thesis and the decision placed UAL in direct competition with the only other airline that had opposed it—Pan American.

In reaffirming the principle of regulated competition laid down when American Export was certificated in 1940 to operate between New York and Lisbon, the Board in its Atlantic ruling wrote as follows:

"As in the domestic system, regulation might result in there being only one carrier in a particular traffic area, but to carry regulation to such an extreme as to place only one carrier in the entire European area would result in depriving the United States of an opportunity of at-

(*Continued on page* 132)

THE VIP EXPRESS

By GAITHER LITTRELL
Western Editor of FLYING

The "Flying Whitehouse" carries Very Important People all over the world.

IN AIRLINE vernacular, "VIP" means "very important people," but it also is being applied now to a Douglas *Skymaster*, denoting "very important plane."

This particular *Skymaster* is known by many names. Douglas refers to it as "Project 51." It is listed by the Army Air Forces as the "C-54C." And in official Washington it is the *Flying White House*. Its crew calls it "Record Setter"—with well-founded reason—and the boys of the ATC, somewhat irreverently, call it *The VIP Express*.

There is only one "Project 51" or "C-54C." Probably there never will be another. It was designed by Douglas especially for the late President Roosevelt at the request of the Air Transport Command.

It carried Mr. Roosevelt to Yalta. It bore President Truman to the San Francisco Conference and more recently to Potsdam. It flew the latter's mother from Kansas City, Mo., to Washington last Mother's Day. Mme. Chiang Kai-Shek flew 5,000 miles in it in one day—from Rio de Janeiro to New York—the "first time any plane flew that far in a 24-hour period," Douglas spokesmen claim.

Secretary of War Stimson, Gen. of the Armies George C. Marshall, Secretary of State James Byrnes—just to mention a few—were flown in it on long-range war missions, as were scores of other top-notch generals and admirals.

Outwardly the plane looks like any other *Skymaster*. Inside it is luxuriously different. Most startling innovation is an electrically-operated elevator set just aft of the main passenger door and operated from batteries. A specially-built collapsible, chromium steel wheelchair could be rolled into it from the ground and hoisted to a corridor in the passenger section.

Lieut. Col. Henry T. Myers is pilot of the VIP Express.

The plane is so constructed that from the elevator door the chair could be moved to virtually any place in the craft. Mr. Roosevelt's favorite position, according to the crew, was between the pilot and co-pilot, where he sat for hours.

The private stateroom is 7½x12 feet and, with its sofa and two electrically-folding chairs, has seating capacity for seven persons. The plane accommodates 15 passengers, can sleep six, and carries a crew of seven.

In the President's "suite" is a swivel chair which is within easy reach of an oxygen mask, reading lights and a telephone connecting with the pilot's compartment and three other staterooms.

A conference table is in the middle of the section, while on one side are four maps on rollers; four enlarged flying instruments, including an air speed indicator, altimeter, compass and clock; and a cabinet, the top of which contains an electric fan. On the other side are chairs and windows. At one end is an electrically-operated bunk which folds into the wall.

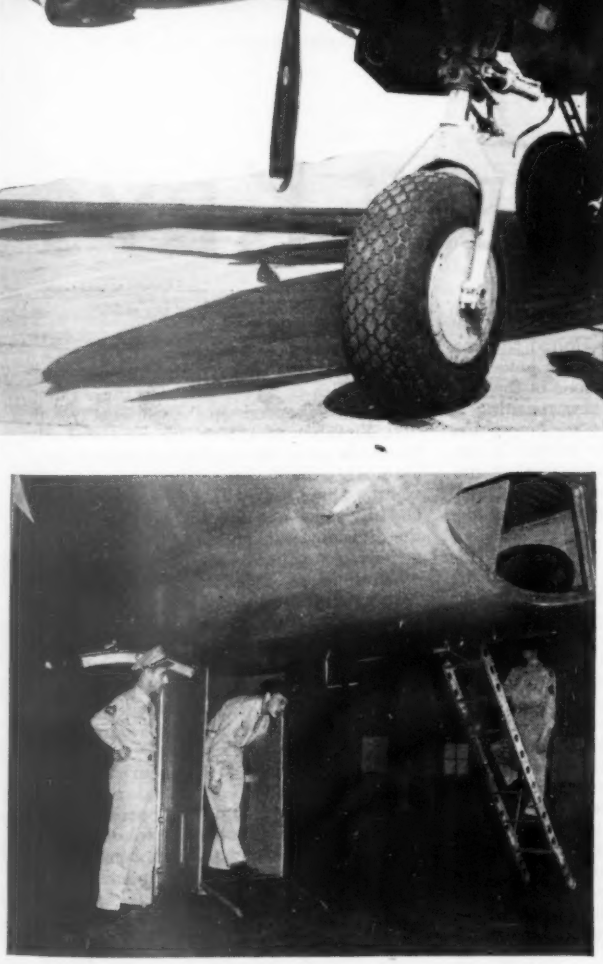
At the other end is an entrance and an adjoining lavatory. All upholstery is blue worsted wool. The draperies are of blue gabardine on which is embroidered the insignia of the Army, Navy, Marine Corps and Coast Guard.

Delivered to the ATC in June, 1944, the plane was designed internally by E.

(*Continued on page* 124)

The interior of the Flying White House has tan gabardine and leather walls and blue gabardine drapes. At left, conference table with countersunk ash trays and the great seal of the United States. Right, large map of world with oversize flight instruments above.

The VIP Express is the only C-54C made. In the past year it set six records in flying over 44 nations—whose flags are painted on its nose.



The battery-operated elevator was installed for an especially-built folding wheel chair used by the late President Roosevelt.

A large divan in the main passenger cabin folds down into a bed. The main cabin seats seven and there are three other staterooms.

Here is but one part of the vast engineering and drafting facilities required to develop Boeing's giant four-engined aircraft.

THREE KEYS

AFTER 40 years of development, American air power has emerged as a dominant force in the world. We have seen its terrible destructive power help crush the most militant nation in history and we are witnessing its onslaught against the ruthless Japanese.

General Eisenhower, in his speech to Congress, said: "To the Air Forces, without whose services all else would have been futile, I—all of us—owe a debt of gratitude." And Field Marshal Rundstedt, who engineered the break-through at Ardennes, revealed: "The greatest single reason for our loss of the war was America's tremendous air superiority. Our offensive at Ardennes failed because your fighter-bombers made it impossible for me to bring up troops and supplies quickly enough."

Such a tremendous and all-powerful weapon places a grave responsibility on each of us. More than that, it is an obligation. Article 49 of the United Nations International Organization Charter states: "In order to enable the United Nations to take urgent military measures, members shall hold immediately available national air force contingents for combined international enforcement action."

Air power is the only force mentioned specifically in the charter for the enforcement of peace among the United Nations. Air power thus becomes peace power.

One of the profound lessons of the past decade in aviation is a new meaning of the term air power. We no longer use it in the narrow military sense. It can only be defined as the sum total of our nation's strength in the air, an integrated trinity of *air force, air commerce* and *aircraft industry.*

The sinew of air power is *air force.* It is the prime weapon of the aggressor of the future. The events of the last six months of the war in Europe, examination of captured German war plants and revelations of captured officers and scientists have combined to present a startling picture of the nature of the next war. Jet and rocket propulsion, guided pilotless missiles, stratospheric bombers and radio-controlled bombs, all will be a part of the war of the future. All are in actual existence and have seen use in this war. The weapons of the next war will be a far cry from even these fantastic devices. The immense potentialities of scientific weapons research and development make the preservation and expansion of our air forces of essential concern to every American.

The heart of air power is *air commerce.* The growth and expansion of our scheduled airlines provided a vast framework upon which the aerial delivery of strategic supplies and personnel for the Army and Navy depended. In the words of General Eisenhower: "The use of airborne troops in this war has just scratched the surface. I think there will be equipment coming along that will not only take special divisions but the full equipment of the division in air and land. They will be self-sustaining and as mobile as any other divisions. We have only started."

It was the trained personnel, equipment and accumulated "know how" of the airline industry that provided the organization for the Air Transport Command and the Naval Air Transport Service. Many of the routes, bases and airways systems now in use around the world by these military commands were pioneered and developed by our commercial airlines.

Personal flying and the operation of non-scheduled aviation activities also constitute a major element in air commerce. We cannot have air power, under a system of democratic government, without an enlightened public opinion and an awareness of aviation and its import. No better avenue of public education exists in this field than thousands of personal pilots flying their own personal aircraft.

It took 1,500,000 engineering man-hours to create the first Super-fortress; the next step in bomber design may take 10 times as many.

TO AIR POWER

By EUGENE E. WILSON
President, Aircraft Industries Association of America

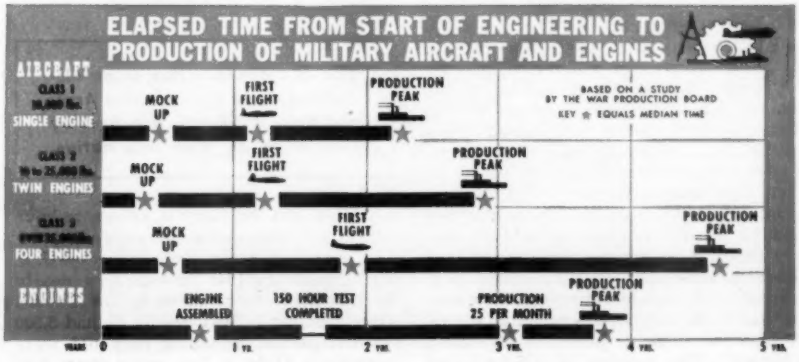
Maintenance of air power demands an integrated program for the air forces, air commerce and aircraft industry.

During the war, private flying schools expanded their activities a hundredfold and provided hundreds of thousands of trained pilots to the Army and Navy. The tremendous job done by these operators has actually resulted in a pilot surplus, although a shortage of trained pilots was once feared as our greatest handicap in preparation for war. Landing facilities, in the form of airparks, airstrips and air harbors, must be made available in every community in the nation so that the personal airplane will be given its fullest utility.

General Arnold says: "There must be in continuous operation an up-to-date training establishment fully supplied with the latest aircraft and equipment. The Army Air Forces and the nation must encourage private flying for it is obviously upon youth that the nation must rely for protection against attacks by aggressors."

Every facet of aviation education must be encouraged for the training of our youth. Surplus aircraft, engines, instruments, accessories and equipment must be made available to all schools throughout the land, teaching staffs must be trained and expanded and even the elementary grades must have some aviation

(*Continued on page* 128)



Fighters take more than two years to get into peak production, heavy bombers nearly five.

JAPAN'S AIR FORCES

The havoc wrought upon the U. S. Fleet at Pearl Harbor quieted the Western powers' pre-war scoffing at Japan's "rumored" air strength.

Jap Army and Navy Air Forces, ridden by rivalry, can no longer take offensive action, concludes OWI report.

AFTER nearly four years of warfare, in the early part of which it nearly defeated United States forces in the Pacific, the Japanese air forces are no longer able to mount a sustained offensive and are even too small to have adequate strength at all critical points in their own defense areas.

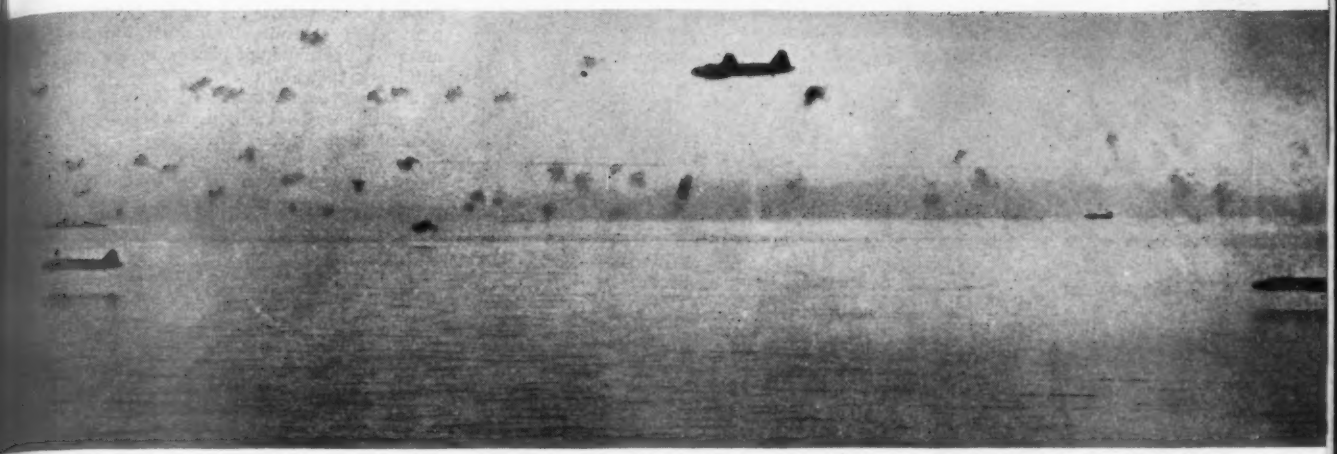
Japanese planes assigned to combat are now believed to number about 4,000, and Japanese air forces air and ground personnel totals about 600,000 persons—contrasted with considerably greater numbers of U. S. combat aircraft and a total strength of U. S. air personnel of nearly 1,300,000. The number of USAAF and U. S. Navy planes in the Orient is not available, but the Navy is known to have a total of 37,000 combat planes of all types.

This is a condensation of an official report on the Japanese Army and Navy Air Forces prepared by the Office of War Information.

A combined Army-Navy report on U. S. air strength in 1941 reveals how nearly the Japanese defeated us in the Pacific. On December 7, 1941, the U. S. had 3,300 combat planes, of which only 674 were overseas. Only a few more than half of the 674 were in the Pacific. After Pearl Harbor, the United States had virtually no planes in the Pacific.

The early success of the Japanese fighters, *Val*, *Zeke*, *Oscar* and *Nate* and the bombers *Lily* and *Sally* gave the Japanese air forces the fatal delusion that they were invincible—despite the fact that their fuel tanks were unprotected, their firepower was inferior, they had no armor, and a burst on a Zeke's tail "would strip off its thin aluminum-alloy skin like a banana peel."

The Japanese air forces were first checked in the Battle of the Coral Sea in 1942 and defeated spectacularly at Midway. That was the beginning of our successful air offensives. Today, most of



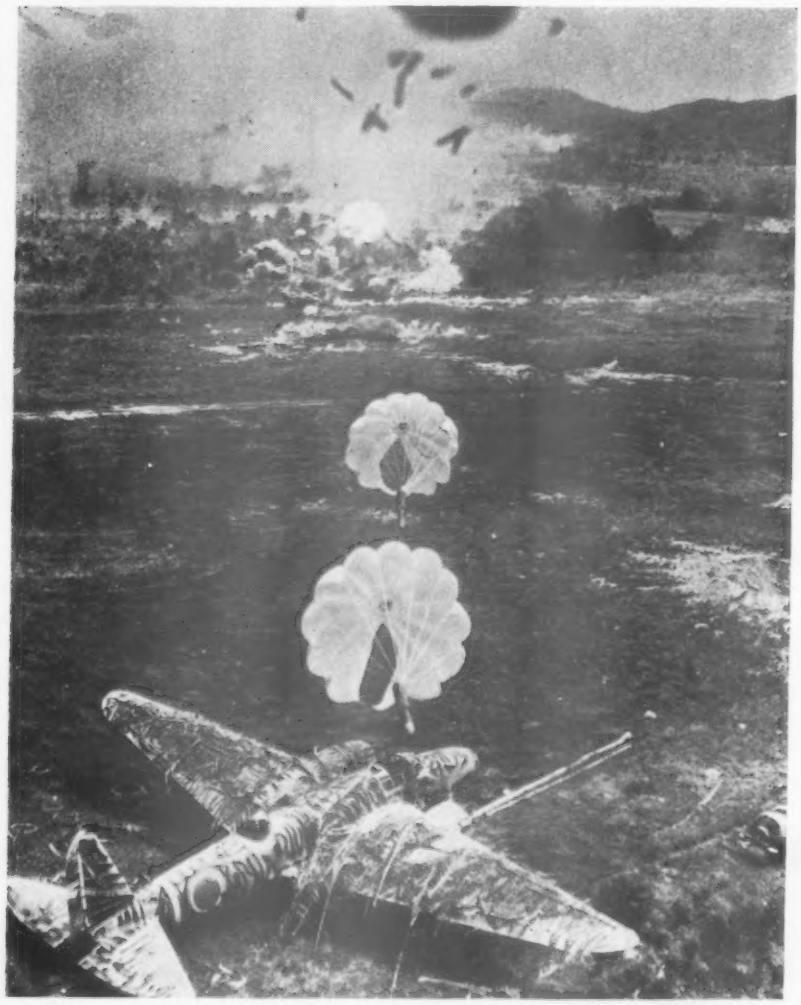
Early in war, Jap airmen were highly skilled, as evidenced by these Bettys skimming water during air attack on transports at Guadalcanal.

Average Jap pilot is 26; 5 ft. 2 in. tall; weighs 122 pounds, has about 10 years of schooling. Depicted above is airman in officer's summer uniform.

Seniors at Military Aviation School, Toyooka, hear officer outline air-duel strategy. Following lecture, future pilots test theories in training planes.

Captured Jap pilots bow heads aboard transport plane enroute to prison camp. Once cocky strutting "supermen," these Nips forgot to die for their Emperor.

Japan's belief in her invincibility, fostered by early successes in the war, withered when modern U. S. planes began to send down her unarmored aircraft in flames.



The Japanese are adept at camouflage but U. S. reconnaissance has flushed their planes out of hiding. Here parafrags from U. S. 5th Air Force drop on a Sally in Boeroe Islands.

Japan's best aviators are dead. Japanese pilot ability, despite intensified training methods, has not kept pace with the expanding responsibilities of air defense and with the ever-increasing Allied air strength, improved Allied equipment and combat flying skill.

Japan's fighting planes are improving in quality, but not enough to match corresponding improvements on U. S. planes. Current production is estimated to be 1,250 to 1,500 planes per month. Japanese aircraft losses, on the other hand, are estimated to exceed 1,000 a month on both air and ground. Between Pearl Harbor and April 1, 1945, U. S. Navy and Marine forces have destroyed in combat or on the ground 11,601 Japanese planes. Army figures are not available.

Another factor likely to result in further Japanese operational inefficiency is lack of harmony between Japanese army and navy air forces which has long been noted by U. S. airmen, reflecting a long, deep-seated conflict.

Today, with their backs to the wall, the Japanese feel that they are fighting a "machine" rather than a people. Japanese communiques from time to time have claimed that Japanese flyers have shot down 500 or more U. S. planes but such announcements are usually followed by figures on U. S. production—of 12,000 planes a month. The war, the Japanese are told, is "man against machine" with a prediction that the spirit of man can and will conquer the machine.

The Japanese air forces appear to have lost the capability for large-scale, sustained offensive action, or even effectively sustained defensive action. Their ability to improve unit strength out of increased aircraft production seems limited by:

1. The continuing heavy losses of aircraft, pilots, crews and command personnel.

2. A probable shortage of adequate, trained replacements.

3. Disruption or elimination of training bases in Formosa, the Philippines and other southern areas.

4. Comparatively inferior maintenance and repair.

For more than a year now the Japanese have been on the defensive in many theaters. In 1944 this condition resulted in:

1. Virtual abandonment of daylight horizontal conventional bombing attacks on Allied land bases or convoys with air cover.

2. Adoption of dawn and dusk bombing by Japanese fighters, and night bombing by medium, torpedo and dive bombers.

On the credit side, the Japanese still retain the capability for:

1. Occasional strong offensive action against our carrier planes and amphibious operations.

2. Numerically strong defense of the homeland.

3. Limited offensive action in China, conditioned by the Japanese policy of conserving their strength.

4. Limited defense of oil producing and refinery areas of Sumatra and Borneo, and strategic Singapore.

(*Continued on page* 85)

YOUR OWN AIRPORT!

Modern, large hangars like this one at Orangeburg, S. C., can be built from profits.

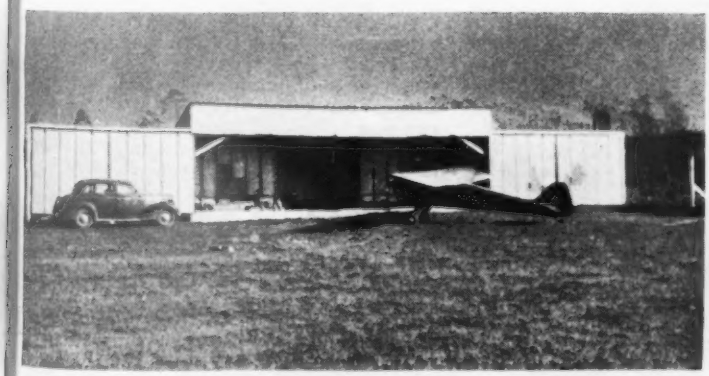
By KURT RAND

Here are some hows, wheres and whats to aid those aspiring to own a small, post-war airport.

SO YOU want to start a small airport—a money-making flight strip at the edge of your home town. And, like thousands of others who have the same yen, you'd like to know what your chances are and how to go about it. All current evidence seems to indicate that your chances are better than good. Here's the picture:

In addition to the 3,000 airports (large and small) we now have, a national airport plan recently submitted by the Civil Aeronautics Administration calls for 3,000 more. Of these new ports, 2,900 will be small airports or airparks—Class 1 or Class 2 fields, with runways 1,800 to 2,500 and 2,500 to 3,500 feet long respectively. But this is only a start; CAA planning provides for Federal co-operation with cities and states in local airport construction. And beyond these limits there is a vast potential of post-war airport development which will depend upon the initiative and ingenuity of young Americans. Estimates of the number of small landing places that will be required by post-war aviation run as high as 25,000.

Such estimates are based on fairly well established facts. There are now 122,000 licensed pilots on CAA rosters. There are about 300,000 more pilots in the air forces. These facts lead to the estimate that there are at least 800,000 who, at one time or another, have held pilot's licenses. Add to this the fact that the 2,500,000 non-flying men in the air forces have been conditioned to flying as no Americans have ever been before and that much the same thing can be said of an-



A one- or two-lightplane hangar, such as this one at Olean, N. Y., airfield could be an adequate start toward owning and operating your own airport.

CAA offers free plans for building low-cost seaplane bases that are improvements over Seaplane Service dock on Ohio River at Cincinnati.

PAMPHLETS ON AIRPORTS

CAA Airport Publications—A free listing of more than 100 publications on airport design and construction. Write Office of Information and Statistics, Civil Aeronautics Administration, Washington 25, D. C.

Airport Design—Free from CAA or send 15 cents to Government Printing Office, Washington, D. C.

Airport Management—Free from CAA or send 10 cents to Government Printing Office, Washington, D. C.

Seaplane Facilities and Suggested Seaplane Ramps—CAA.

The Small Airport (in preparation)—CAA, Washington, D. C.

The Small Business—Armed Forces Institute, Madison, Wis.

National Airport Plans—House Document No. 807, House Document Room, Capitol, Washington 25, D. C.

How to Make Small Airports Pay with Aeronca—Aeronca Aircraft Corp., Middletown, O.

What Your Town Needs for the Coming Air Age—Piper Aircraft Corporation, Lock Haven, Pa.

Community Airports and Airparks—Standard Oil Co. of New Jersey, 26 Broadway, New York 4, N. Y.

Put Your Town on the Air Map—Aeronautical Chamber of Commerce, Shoreham Building, Washington, D. C.

A Distribution Analysis of U. S. Postwar Personal Plane Markets—McGraw-Hill Publishing Company, 330 West 42nd Street, New York, N. Y.

Additional source material is listed in this article. Where prices at Government Printing Office are given, CAA in most cases would provide the pamphlets free to servicemen.

This surplus Taylorcraft having its NC number stenciled on the rudder is typical of the type of lightplane suitable for starting operations on a small airport.

Flight instruction is a most important source of income for the airport operator. For this reason, any small operator should be a qualified pilot with an instructor's rating.

other 3,000,000 men and women who have been working in airplane and aircraft parts factories. Then there are the hundreds of thousands of boys and girls who have recently come of flying age and are already crowding our flying schools. Industry is ready to wager that there are 16,000,000 men and women between the ages of 40 to 50 who will be potential customers for an improved post-war lightplane.

Of course, only a small per cent of these potential airport users will be in the market for personal planes for some time after the war. The most optimistic forcast places the number of lightplane sales at 450,000 during the first 10 years following the war. But the average of seven such forecasts made by aviation leaders is 210,000 sales—which makes the estimate of 25,000 airports quite within reason.

What, then, are the chances for persons of moderate means to enter this hightly promising field? What, specifically, can the returning serviceman expect—the man who has contracted a severe case of flying fever but who has little more than the $2,000 loan provided in the G.I. Bill of Rights with which to satisfy it?

The answer to such questions is pretty well summed up in a statement made recently by Al Bennett, former operator of an airport at Hightstown, N. J., and now sales manager of Aeronca Aircraft Corp. Bennett, whose students have initiated dozens of successful airport projects, insists that "a small airport can be owned and operated profitably by any person of moderate business judgment who is willing to do an honest day's work." Many of Bennett's proteges have had little more than that to invest. They have found fields suitable for small landing strips, bought a plane or two and (with the application of sound business methods and hard work) have built successful fixed-base operations. Here are some of the simple rules they have followed:

1. Select a suitable field (with the help and advice of a practical pilot or CAA inspector or airport engineer).
2. Rent it on the best possible terms.
3. Start giving flying instruction, sightseeing flights and charter flying, with one plane, bought on time.
4. Provide hangars, offices, facilities, new planes and new services only as profits seem to warrant.

The size of the field, its proximity to town, the use to which it is now being put—these will determine its rental cost. Rental costs will vary throughout the country. The returning serviceman may already have some knowledge of land rent near his town or he can get a "round number" figure by writing a simple letter to a real estate man back home. The Department of Agriculture says the average grazing and tillable land rent throughout the whole country is $4 an acre per year. Actually it varies from 25 cents to $100. Near towns where real estate activity has increased land value, rates will be higher. The Department of Agriculture says $5 to $10 a year could be considered a national mean average.

Taylorcraft Aviation, Alliance, O., has

(*Continued on page* 112)

Where Would You Land?

Which field would you select for a forced landing if your engine should quit suddenly?

GOOD judgment in making forced landings is one of a pilot's best accomplishments. The accompanying photographs show various types of terrain in eastern and midwest states on which you might have to make a forced landing. This information is all the more important now that the new CAA regulations no longer require simulated forced landings as part of the private pilot examination. Photographs of mountainous regions are not included in this series because of the multiplicity of conditions governing forced landing in such areas.

In the hypothetical circumstances described here, surface wind velocities are assumed to average from eight to 10 m.p.h. in the midwest and from 10 to 12 m.p.h. in the east.

Wind direction on the photographs has been indicated by arrows. The interpretation of the general terrain and surface characteristics was checked by experienced flight instructors and by J. Marvin Coltice, photo-interpretation expert of the Department of Agriculture.

Simulating forced landing over reasonably level terrain from 1,000 feet, pilot of Waco UPF-7 begins glide toward field of his choice.

At first glance, this terrain, as seen from 900 feet near Mount Pleasant, Ill., may seem well-suited to forced landings. Actually, only two fields could be used with reasonable safety. Fields A, B, C, E, F and H have crops of growing corn which could be hazardous. Field D would require a cross-wind landing and has grazing stock in the fenceless adjoining pasture. With a dead engine, the best field with sufficient width and length is that on which the wind arrow is shown. If some power is still available, Field G could be used. It is a cut-over grass strip, 1,230 feet long. Surface depressions, indicated by I, should be avoided. Field H is beyond gliding range in a complete power-off emergency landing.

ing pasture. With a dead engine, the best field with sufficient width and length is that on which the wind arrow is shown. If some power is still available, Field G could be used. It is a cut-over grass strip, 1,230 feet long. Surface depressions, indicated by I, should be avoided. Field H is beyond gliding range in a complete power-off emergency landing.

Rolling farmland from 400 feet near Loup City and Ashton, Neb. An engine failure over such terrain from this altitude calls for quick thinking. First, Field A, right foreground, has been recently plowed and should not be used unless strong surface winds will restrict the gliding distance. The rolling surface marked C is sufficiently smooth, but would not be reached if the engine were dead. The area marked D has a few horses grazing at the far end but a safe glide could be made to the field if they could be avoided. However, if power is available, Field C is the best for a landing, though it would be slightly cross-wind. Always avoid gullied areas such as those marked B, which could cause a crackup in landing.

From approximately 1,000 feet the highly-cultivated lands of Long Island, with wooded areas and ocean inlets, present entirely new landing problems. Off-shore winds create a cross-wind condition for most of the fields shown here. Those choosing Field A, a 960-foot strip of low grass, should note the difficult approach due to power lines on each side of the adjoining road. Field B is somewhat shorter, 860 feet in length, with a cut-over grass surface but it has a good approach onto fairly level ground. Field C is somewhat longer than B but slopes off to the right. Its surface is considerably rougher but, like B, has an unobstructed approach. Either field could be glided into easily from a 360° overhead pattern.

joining road. Field B is somewhat shorter, 860 feet in length, with a cut-over grass surface but it has a good approach onto fairly level ground. Field C is somewhat longer than B but slopes off to the right. Its surface is considerably rougher but, like B, has an unobstructed approach. Either field could be glided into easily from a 360° overhead pattern.

The above treacherous-appearing area in the vicinity of Eastford, Conn., is viewed from a 600-foot altitude. Selection of a field here, however, is comparatively simple—Field A is the only suitable open ground within gliding distance. It is only 350 feet in length but is fairly smooth and level. Brakes on the lightplane would be a great advantage in a spot like this. Fields B and C are more directly into the wind but B contains some obstacles and has a sharp slope toward the lower left corner. Field C is rough and has fairly high relief. If the engine is still producing enough r.p.m.'s to sustain flight, Field D is probably better than A, but could never be reached if a dead-stick landing were necessary.

Here you look down from 700 feet in the vicinity of Big Bend, Wis. All suitable fields could be reached with or without power in the event of an emergency landing. Fields A, B and C are eliminated because A has a ditch (indicated by arrow), B is a planted truck lot and C is cut-over corn land offering a rough landing surface. Field D, 830 feet from arrow to arrow, could be used but its surface is rough grassland and trees and water are approach hazards. Area F is a rough, broken field with patches of soft ground. Best fields are E and G. Since the strip next to the cornfield continues into the adjoining field, giving adequate length, the latter is most desirable. Field E possibly has a fence-row at point of arrow.

G. Since the strip next to the cornfield continues into the adjoining field, giving adequate length, the latter is most desirable. Field E possibly has a fence row at point of arrow.

Below our 800 foot-high point of observation is a portion of the Antietam battlefield near Sharpsburg, Md. Of the three fields designated on the near side of town, Field C, with its close-cropped 830-foot grass surface, is the best. It has fairly high relief with a gradual slope in the direction of the arrows. Field A is 1,100 feet long but is a rough turf pasture requiring plane to land into a quartering wind. Field B, with shocked corn, is ruled out. If the engine is dead, it would be inadvisable to cross the town. Field D could be reached but the steep slope makes it poor for landing. Fields E are rough with quick changes of slope. Although smooth, F or G could not be reached in a power-off glide.

You are at 700 feet near Centralia, Ill., when the engine fails. Before you head for Field B, note the buildings and trees in the approach path, also the deep-rutted wagon path (arrow). Field A looks good but is too far away for a power-off glide. It also slopes downhill, prolonging the landing roll and requiring a cross-wind landing. This leaves Fields C and D, either of which are suitable. C has an uphill slope, into the wind, reducing the landing roll; D is level, smooth and has an unobstructed approach path.

THOUGH there are fewer forced landings today than there were 10 years ago, they still occur. A number of circumstances can result in an emergency landing in some area other than an airport—sudden, excessive vibration, loss of r.p.m.'s, abnormally high engine temperature and dropping off of oil pressure, not to mention complete engine failure.

An understanding of the countryside is essential. Of importance is the checkerboard pattern in those states laid out in section lines. In many parts of the country the predominant pattern of rural roads is laid out on such lines, one mile apart. This is of great value in judging the length of a prospective landing field.

Another distance-determining aid is telephone poles, normally placed 150 feet apart. If parallel with the field selected, the field's approximate length can be determined from aloft by making a quick check on the number of poles.

(*Continued on page* 146)

By FRANKLIN D. WALKER

LONG-awaited revisions of Civil Air Regulations have now become effective and many of the rules controlling students and private pilots have been wiped out. (See also page 80). A surprising, last-minute change abolished the written examination for a certificate, a drastic move not anticipated by qualified pilots, instructors and operators.

Under former regulations a student was required to take a short written test on CAR before he made his first solo. That, too, has been dropped but the student must submit to a written test (about 25 questions on traffic rules and miscellaneous regulations) before he can be permitted to begin his solo cross-country flight. When a student applies for his private certificate he merely takes a flight test.

Also discarded is the provision which called for knowledge of weather conditions, weather maps, navigation, chart reading, safety practices and procedures. The flight test itself has been simplified. The regulation prescribing a minimum of eight hours of dual instruction before solo has been eliminated, permitting a student to solo whenever his instructor thinks he is ready. Forced landings are no longer mandatory and the angle of bank in a 720° turn has been reduced from 60° to 45°. Another omission is the requirement that a competent operator be at the controls when an engine is being started.

Any registered physician may now give a medical examination and the prospective pilot will "pass" unless he has an ailment that might incapacitate him in the air. The minimum age for a pilot's certificate has been dropped from 18 to 17 years; log books no longer are required. Any private pilot may give flight instruction but he must not accept payment.

Traffic rules of the air have been liberalized. For flights over cities and towns, the minimum altitude remains unchanged —at least 1,000 feet and high enough to glide to a landing outside congested areas. Elsewhere, however, when his flight "does not endanger persons or property on the ground," the pilot may skim the treetops or do fancy grasscutting if he so desires.

Contact flight restrictions on pilots flying under low ceilings have been modified. When the ceiling is less than 700 feet the pilot may fly right up against the cloud base. When flying at altitudes above 700 feet, the pilot must maintain a separation of 500 feet from the cloud base. This regulation makes the minimum separation 300 feet instead of 500 feet between planes flying contact at low altitudes and planes flying in the overcast on instruments.

DPC Hercules

The much-discussed HK-1 has been renamed the Hughes *Hercules*, removing Henry Kaiser's name in connection with the eight-engined monster at Culver City. Scheduled to make its maiden flight in September, the *Hercules* probably will not fly before the end of the year because of engine trouble. One of the big radials, designed for a 3,000-h.p rating, recently blew up on a test stand.

Moving the plane from Culver City to the lagoon near Long Beach for the first take-off will necessitate the temporary removal of 70 big power line standards. The entire *Hercules* project will cost approximately $15,000,000, but the boat will carry only $4,000,000 worth of insurance when it takes to the air. It will have a crew of 10 and a pilot yet to be selected. There are numerous volunteers for the piloting job.

One of the chief difficulties with a plane this size is how to anchor it. Mooring the plane, which has a wing span of 320 feet, will be extremely difficult on water fronts where the wind is constantly shifting. C. W. Perelle, general manager for Hughes, reports that while the first plane is of wood its successors (if there is a demand for this type) will be of metal. The *Hercules* is the only plane financed by Defense Plants Corporation.

Pusher to Tractor

From an excellent source comes the report that all pusher-type transports and bombers in the mill, such as Convair's Models 37 and XC-99 (military cargo version of Model 37) are to be re-designed for tractor-type propeller and engine arrangements. With propellers and engines at the rear all sorts of operational problems are being anticipated by aircraft engineers, the worst being extremely high landing speeds. It is understood that flaps spill air out into the prop path, making prop efficiency quite low unless engines are kept revved up considerably. Another bad feature anticipated is icing. Leading edge ice formations when cut loose would strike the props with dire results. Such a change from pusher to tractor probably would mean complete re-designing of these planes.

Flip Cochran

Col. Philip Cochran, colorful veteran of the North African and Burma air wars and prototype of the Flip Corkin character once the life of the party in Caniff's Terry comic strip, seldom conceals his dislike for the big, heavy, single-engined fighters. As a staunch advocate of the very light, very fast and highly-maneuverable fighter, Colonel Cochran (then a major) once listened to a detailed explanation of the job the Curtiss XP-62 was designed to do. Bigger than the *Thunderbolt* and bristling with cannon, this pressurized behemoth, he was told, would be a devastating fighter and bomber-destroyer, capable of knocking down the highest-flying enemy heavies. Cochran's aside remark, as he glanced at the giant again, was: "Yeah, but will it mix a salad, too?"

Global Weather Service

Correspondents at the International Civil Aviation Conference neglected to mention (or were unaware of) plans formulated by meteorologist-delegates for a world-wide weather service after the war. The plan proposes that each nation agree to organize within its borders a weather set-up very much like the U. S. Weather Service. Delegates accepted the broad scope of the tentative agreement and further discussion is scheduled for sessions of the interim council conference in Montreal. If the weather plan as outlined is incorporated in the permanent documents of a world civil aviation group, all countries will participate in an effective interchange of weather data and each will make its weather service available to international air lines and itinerant aircraft without discrimination.

Japan-Saipan Express

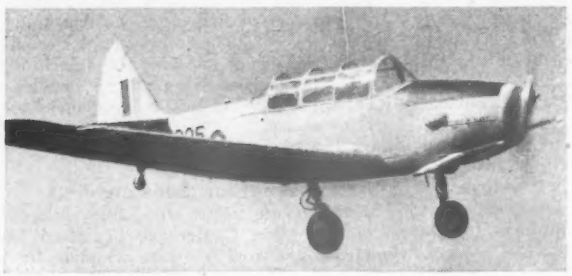
Coming home always seems shorter than the trip out, regardless of the type of transportation, but crews of many of the *Superfortresses* know that the flight back to Saipan from Japan can be shorter by hours than the flight to the target area. And not only because their loads have been dumped. They ride the winds, which at certain altitudes in that area

(*Continued on page 142*)

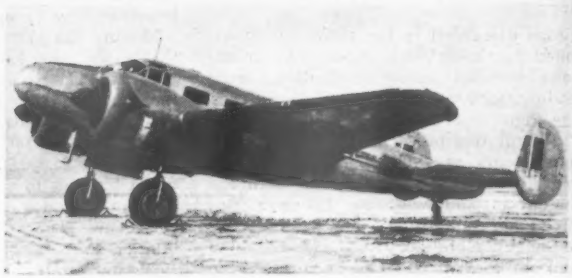
SALVAGING OUR S

IN CANADA

Seven Hudson bombers have been sold for conversion into air transports.



By May 1, Canada had sold 58 Fleet Cornell elementary trainers for an average price of about $2,500 each.



A Beechcraft UC-45 like this went to an American buyer for $16,500. Canada has sold many transport aircraft.

Though private flying still is banned, the War Assets Corporation will offer about 4,000 planes through regular trade channels.

By JAMES MONTAGNES

SURPLUS Canadian warplanes that are potentially useful for peacetime transport operation are finding their way to all parts of the North and South American continents. Canada's government-owned War Assets Corporation (WAC) has received requests for all types of aircraft and spare parts at its head-office at Montreal, at regional offices throughout Canada, at Washington, London and other national capitals where the Canadian government has embassy or legation offices.

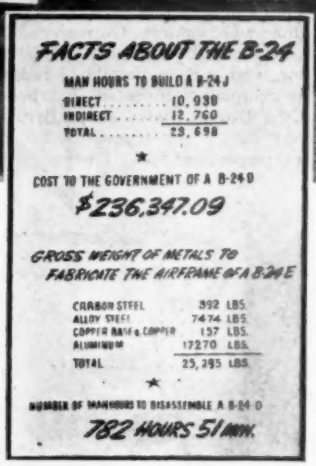
Early in 1939 Canada made its bid as a producer of trainer and combat aircraft. Since then planes from Canadian factories have been in use in all war theaters. Canadian aircraft plants have produced not only British and American type trainer and combat aircraft (including the *Mosquito* and *Lancaster* and Curtiss *Helldiver*) but also such Canadian-designed trainer and transport aircraft as the *Anson*, *Cornell* and *Norseman*. Canadian aircraft production since the start of the war (1939) until April 30, 1945, totaled 5,690 combat planes, 6,287 advanced trainers and 3,686 elementary trainers, a total of 15,663.

Though no large numbers of combat aircraft have as yet been placed on sale, some 4,000 aircraft of other types will be offered by WAC during 1945. These

(*Continued on page* 136)

SURPLUS WARPLANES IN THE U.S.

Industrialists who studied this disassembled Liberator were pessimistic about the cost of breaking it up but saw sales value in instruments and some of its components.


FACTS ABOUT THE B-24
MAN HOURS TO BUILD A B-24 J
DIRECT 10,930
INDIRECT 12,760
TOTAL 23,690
COST TO THE GOVERNMENT OF A B-24 D
$236,347.09
GROSS WEIGHT OF METALS TO FABRICATE THE AIRFRAME OF A B-24 E
CARBON STEEL 392 LBS.
ALLOY STEEL 7474 LBS.
COPPER BASE & COPPER 137 LBS.
ALUMINUM 17270 LBS.
TOTAL 25,295 LBS.
NUMBER OF MAN HOURS TO DISASSEMBLE A B-24 D
782 HOURS 51 MIN.

Costly warplanes some day will be worth only their scrap value.

More than 40,000 planes already have been declared surplus, and problems of selling, salvage and scrapping have just begun.

By PHILLIPS J. PECK

Staff Writer, International News Service, Washington, D. C.

ON 57 storage fields throughout the United States hundreds and thousands of war-weary combat planes grounded by V-E Day are piling up. Within six weeks after victory in Europe more than 2,500 combat planes were declared surplus. The flood still continues.

The Aviation Division of the Surplus Property Board in Washington now is confronted with the full reality of a problem long foreseen in theory—the disposal of billions of dollars worth of fighting aircraft.

During the first 15 months of its existence the surplus property organization's job was comparatively simple. It received thousands of civilian types—primary and basic trainers and transports—and disposed of many of them quickly at fixed prices by competitive bids or allocations to foreign and domestic airlines.

There also were some 4,700 combat planes mixed in with the pre-V-E Day declarations of surplus aircraft but the deluge did not begin until the surrender at Reims. In six weeks more than half as many combat planes were declared surplus as in the preceding 15 months.

As of June 15, 1945, the number of airplanes of all types declared surplus had reached 39,317, with an original cost of $1,749,343,000. Less than one-fifth of the

(*Continued on page 118*)

LONDON Letter

By Maj. OLIVER STEWART

British Authority, Editor of Aeronautics

SO FAR there has been no noticeable official reaction to complaints in the London *Daily Mail* that United States newspapers named the new British aircraft *Vampire*, *Hornet* and *Lincoln*, while British papers were still prohibited from doing so for security reasons.

This complaint materialized at intervals during the war against Germany. It cropped up about the *Tempest*, the *Griffon* engine, and certain details of radar. The same complaint—inverted—has been made in the United States about British newspapers.

Your correspondent looks on the argument as a good sign, indicating that artificial war restrictions are on the wane and that we shall soon return to competitive news-getting. But although security requirements for the war against Japan should be fewer than for the war against Germany, those that do remain must be strictly enforced.

D. H. Jet

The *Vampire* is a 500-m.p.h.-plus de Havilland aircraft with a de Havilland jet unit. The engine company (which is separate from the aircraft company of the same name) has been working on jets under the guidance of its chairman, Maj. Frank Halford, designer of the most unconventional piston aero-engine in general use today, the Napier *Sabre*.

The *Sabre* (which powers the *Tempest* and *Typhoon*) is a 24-cylinder twin-crankshaft, liquid-cooled, sleeve-valve engine with its four cylinder-banks arranged like the arms of the letter H lying on its side. Halford has now left Napier and concentrates all his attention on de Havilland work. An original thinker, he has been in the thick of engine design since World War I. He obtained useful experience on high speed units with small cylinders when he raced his own automobile, the Halford Special, at Brooklands track.

The 470-m.p.h. de Havilland *Hornet* is a scaled down *Mosquito* with two *Merlin* engines.

The Short Shetland is a new British flying boat weighing almost 61 tons. Here it is sharply banked by test pilot Geoffrey Tyson in demonstration of its maneuverability.

Longer Ranges, Larger Loads

The Avro *Lincoln* is a scaled up *Lancaster*. The Royal Air Force will use it against the Japanese. It can take the 12,000-pound and the 22,000-pound bombs, and its total bomb load is greater than that of the *Lancaster*.

For further stretching the range or the bomb load to Pacific needs, refueling in the air might be considered. The system was developed by a pre-war pioneer of British Empire air-routes, Sir Alan Cobham.

Flight refueling is a tricky business, for unless the technique is right the fire risk is considerable. During his experiments Cobham took to washing out the fuel hose with an inert gas before and after passing the petrol through it. He also devised methods of picking up the pilot cord attached to the pipe line, though work on this had already been done by Farnborough.

Landplane Or Flying Boat?

Official opinion in London is generally unfavorable to the flying boat but development of such boats in Britain has not ceased. The long-promised, long-delayed demonstration of the British 58-ton (60.9 U.S. tons) Short *Shetland* showed that it possessed amazing handling qualities.

Photographers perched on the roofs of a hangar wanted flight close-ups and test pilot Geoffrey Tyson promised them. With a party of correspondents aboard he took the great boat back and forth a few feet from the photographers, making steeply banked turns at the end of each run until the correspondents began to wish they were wearing Dr. Dranks' G-suits.

Later, when Charles E. Brown, England's best air photographer, was in a *Sunderland* with a *Shetland* flying alongside he "posed" the 61 tonner by beckoning it in, or holding it, with a raised forefinger. The only thing he could not do was make it smile.

Quick Compromise

Your correspondent was well impressed by the design of the 27-passenger Vickers-Armstrongs *Viking* medium transport (two Bristol *Hercules* engines). It will

(*Continued on page* 138)

Gas turbine-propeller engines have less than one-fourth the frontal area of radial engines. Here is how they would look on Constellation.

THE GAS TURBINE IN AVIATION

By CHARLES D. FLAGLE
Design Engineer, Aviation Gas Turbine Division, Westinghouse Electric Corporation
and FRANK W. GODSEY, Jr.
Manager, New Products Division, Westinghouse Electric Corporation

The gas turbine-propeller engine is superior to the reciprocating engine at all speeds, say the authors.

THROUGHOUT its history, aviation progress has been paced by the development of airplane engines. The constant trend has been toward bigger and faster airplanes, consequently toward more powerful engines. Until recently, airplanes were driven only by reciprocating internal combustion engines. Now there are new power plants and of them, two will undoubtedly figure largely in aviation of the near future. One of them is the jet propulsion engine; the other is the gas turbine-propeller drive. Both will have continuous combustion gas turbines as the prime mover.

While the reciprocating engine undoubtedly will continue to hold its present position in the field of low power and for planes of low speed, the gas turbine will come into its own both as a jet engine and for driving propellers in high powered planes and for high speed flight.

Of the three types of power plants, the gas turbine-propeller engine has characteristics that give it superiority over the reciprocating engine in all speed ranges and over the jet engine in low and intermediate speeds. Figure 1 (next page) shows the probable fields of use of these types.

These conclusions are reached by comparing the performances of airplanes in which each of the three types of engines might be installed.

Power ratings of reciprocal engines have reached a point where further major increases probably can only be attained by improvements in fuels or the addition of cylinders. The diameter or frontal area of engines is already limited by allowable piston speeds. Larger engines are longer engines and the specific weight is more apt to increase with power rating than decrease.

Unfortunately, reciprocating engines capable of delivering several thousand horsepower require controls, accessories, and exhaust disposal systems which complicate installation and maintenance problems to an extent that limits further large increases in power rating.

The reciprocating engine is by nature adapted to cruising flight rather than sustained high speed flight. Its highest efficiency and greatest reliability are achieved only when the engine is operated below 60 per cent of rated power. An underpowered airplane is constantly plagued by power plant troubles of a mechanical nature.

Jet propulsion of aircraft recently has become a subject of much publicity and confusion. In jet propulsion, all the power output of the engine is used to accelerate the air taken into the engine to a jet of approximately acoustic velocity which is expelled through an exhaust nozzle. The resultant thrust felt by the engine housing is the reaction to the force required to accelerate the intake air to its exhaust velocity. The gas turbine operates by inducting air, compressing it, adding heat at high pressure, and expand-

ing the high temperature combustion products. The major part of the energy is recovered in expansion through the turbine blading and must be used to supply energy required for compression. The remainder of the expansion can be made to take place through a nozzle, where the energy appears as kinetic energy of the exhaust gases.

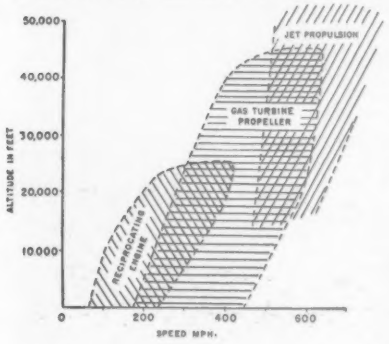


Figure 1.

Figure 2 shows an axial flow type jet engine in which the compressor, combustion chamber and turbine are arranged in line so as to present the minimum frontal area. Some jet engines have been built using centrifrugal compressors, giving a machine of larger diameter not so well suited aerodynamically for installation in a high speed airplane.

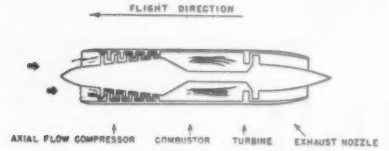


Figure 2.

Principal advantages of the jet engine are its simplicity and light weight. The installed weight of the jet propulsion engine is little higher than its dry weight since little oil is required for lubrication and the engine itself requires no external cooling provisions.

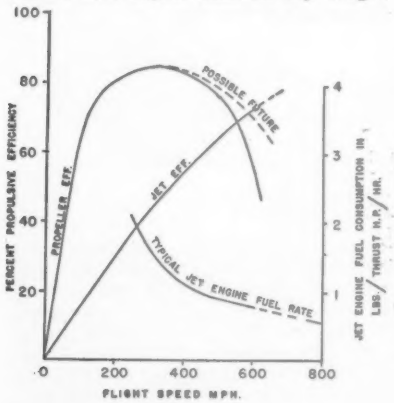


Figure 3.

The jet engine's thrust is relatively constant over normal airplane speed ranges. Therefore the rating of a jet engine is usually given in terms of thrust rather than horsepower and means nothing from a power standpoint until the speed is also given. A thrust of one pound at a speed of 375 m.p.h. is equivalent to one h.p.; at lower speeds the power rating decreases and at higher speeds it increases in direct proportion.

An adjustable pitch propeller is capable of converting shaft power into thrust h.p. rather efficiently over a wide range of airplane speeds but the jet's efficiency is quite low at low speeds. This is shown in Figure 3, in which it can be seen that present jet efficiency does not equal propeller efficiency until flight speeds of about 500 m.p.h. are attained. Below this speed the jet efficiency, consequently its fuel economy, is inferior. The fuel efficiency of a jet engine is low, principally because of the jet efficiency characteristic; second, because the gas turbine itself, operating at a low compression ratio, is handicapped in efficiency. At 375 m.p.h. the apparent or test stand propulsive efficiency of a jet engine will be less than half that of the conventional power plant. Its take-off thrust will be one-fourth that of a propeller with the same power rating at 375 m.p.h. It gives excellent high speed performance at the expense of range.

It is significant that jet efficiency overtakes propeller efficiency in a speed range in which compressibility effects impose critical aircraft design limitations. Much aerodynamic research must be carried out before jet propulsion can be utilized to its best advantage.

A simple open cycle gas turbine can be built today to work at a peak temperature (temperature of gases entering the turbine) of 1,500°. With further metallurgical progress, the life of highly stressed turbine parts operating under high temperature will be increased and the limiting cycle temperature may be elevated above 1,500°. With a compression ratio of 10:1 and compressor and turbine efficiencies of 85 per cent, a fuel efficiency of 26 per cent can be achieved. By increasing compressor efficiency to 87 per cent and turbine efficiency to 89 per cent we may expect a rise in efficiency to 28 per cent at standard sea level conditions. At 15,000 feet, due to low temperatures, the cycle efficiency rises to 31.5 per cent.

A schematic illustration of a gas turbine geared to a propeller is shown in Figure 4. In appearance, the axial flow gas turbine for propeller drive will be a symmetrical machine, its reduction gear concentric with its rotor. Its diameter will be less than half that of a conventional engine of comparable power, permitting it to be buried easily within a fuselage or wing. Presenting little frontal area and requiring no external cooling air for itself, the gas turbine offers very little drag at high speeds. This, in addition to the fact that the gas turbine efficiency is best at its peak load, points to the adaptability of this type of power plant to high speed flight.

The efficiency of a gas turbine is highest at its rated load and rated r.p.m. As r.p.m. decreases, the efficiencies of compression and expansion drop off and the compression ratio also decreases rapidly. Since the useful power output of the machine is the relatively small difference between the power developed by the turbine and power absorbed by the compressor, any change in compressor or turbine efficiency is magnified in its effect on power output. In fact it is doubtful if the turbine output will be sufficient to drive the compressor—much less supply power to the propeller—at much below one-half rated speed. Idling speed for a gas turbine-propeller drive will be between one-half and two-thirds the rated r.p.m.

The gas turbine for propeller drive operates on four to eight times the quantity of air used by a reciprocating engine of comparable power. A controllable exhaust jet thrust supplements the propeller.

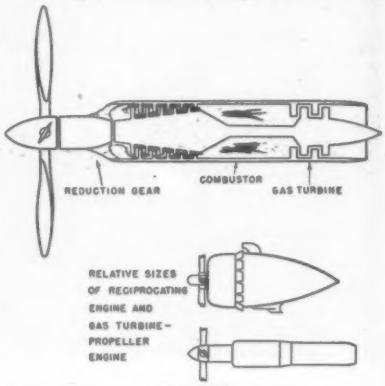


Figure 4.

The gas turbine will permit a much lighter power plant installation than will the reciprocating engine. The installed weight of the geared gas turbine engine should be less than three-quarters the weight of the equivalent reciprocating engine installation.

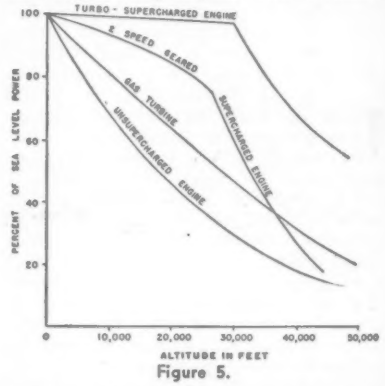


Figure 5.

In general, operations at normal flight altitudes are favorable to economical turbine performance. It is interesting to note that for rough approximation purposes the exhaust jet thrust just about compensates for propeller losses and nacelle and cooling drag.

The gas turbine is not a supercharged engine. Therefore the selection of power rating must be based on altitude requirements. For sea level operation considerable excess power usually will be available. Typical power availability curves for various types of power plants are shown in Figure 5.

The reciprocating engine, in its normal

(*Continued on page* 106)

AS I SAW IT

By MAX KARANT
Managing editor of FLYING

FLYING's managing editor, now touring Europe, compares U.S. and German research and tells of vast bomb damage in Reich. U.S. precision bombing called most effective by the Germans

Dr. Richard Vogt, chief Blohm & Voss designer, declared that pin-point bombing, as at Marienburg, above, was vastly more effective than British area bombing.

GERMANY today is unassailable proof of the fact that air power is the deadliest weapon yet used by man. Critics of our military aviation—particularly those senators and congressmen who voted down appropriations for aviation research in the years immediately preceding this war—should be brought over here and shown the things I have seen.

Metropolitan Germany has been all but wiped out. Nearly 50 German cities have been obliterated from a military point of view (75 per cent or more destroyed). Of Germany's colossal rubble heap, I have seen so far Cologne, Dusseldorf, Duisberg, Essen, Osnabbruck, Bremen, Hamburg, Fallersleben, Brusnick, Hannover and Munich. Any one of these cities would serve to substantiate the case for air power for all time. All of them are a shambles. Loss of life in each is a horrible thing to contemplate. In Hamburg, for instance, it is estimated that nearly 200,000 people were killed; total casualties for that city were approximately 400,000. Allied officials also estimate that there are still about 100,000 bodies buried in Hamburg's wreckage. And that is just one German city.

Nothing of any military importance in Germany was invulnerable to Allied air power. I saw several of Germany's supposedly bomb-proof submarine pens at Hamburg, each punctured one or more times by the 12,000-pound bombs dropped by the RAF. Submarines inside the six-foot-thick concrete and steel pens were blown apart and sunk in the explosions.

Gigantic underground factories, popularly believed to be the answer to air attacks, were isolated and strangled by strategic air operations. All sources of supply, power and communications for such factories were kept cut off by Army Air Forces bombers and fighter-bombers.

The air battle raged over the remotest corners of Germany. Nothing escaped the eye of the photographic reconnaissance planes and the bombers that inevitably followed. When flying around Germany today one can see the handiwork of the bomber and fighter-bomber in city, village, forest and field. Even the most remote farmer's field may have a crater from a bomb which missed a nearby target, or which was jettisoned from a bomber in trouble. Everywhere, too, are little blobs of wreckage that mark the end of a shot-down American, British or German warplane. Hundreds of these wrecks lie in Germany today, just as they fell a few months ago.

I am flying around Germany, France and Italy with a party of aviation writers from the United States. We flew to

(*Continued on page 140*)

The Germans told FLYING's editor that some phases of American research, such as the Mustang laminar flow wing tested here at North American, were ahead of their own designs.

CLOTHES MAKE THE SUPERMAN

Pneumatic "muscles" of the G-suit protect air crews against blackouts normally induced by combat maneuvers in planes like the Helldiver.

By Maj. Gen.
DAVID N. W. GRANT
The Air Surgeon

G-suit application of pressure to pilot's abdomen and legs prevents blood from pooling in the lower extremities and helps the heart to maintain circulation to brain during pullouts and turns.

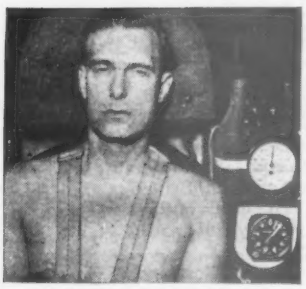
BLACKOUT was encountered even by the pilots of the frail planes of World War I. Far more today it has been one of the major obstacles to full utilization of the speed and strength of modern aircraft. The flying services have answered this problem with the development of a simple G-suit which now enables pilots to withstand forces of eight or nine G without blacking out.

The primary cause of blackout is abrupt anemic anoxia of the brain resulting from a sudden stopping of blood through the brain. The great accomplishment of the G-suit has been to prevent this circulation stoppage and thus prevent blackout in abrupt combat maneuvers.

The human body is organized to function at one G—that is, at 1 x the weight produced by gravity on a body at rest. Straight-line acceleration, with its increase in G, ordinarily presents the pilot with no special problems, but change of direction results in centrifugal force, an increase in G which can produce blackout. The higher the speed and the shorter the radius of turn, the greater the G.

Since both the human body and the airplane are able to take far greater force in a downward than in an upward direction, all flight maneuvers at present evolve around loops and turns in which the under surfaces of the aircraft receive the stress. The pull is perpendicular to the line of flight and the effect on the (*Continued on page* 92)

Capt. Clarence A. Maaske demonstrates stages of blackout on Wright Field centrifuge.



1 Subject suffers no loss of vision, little discomfort, as centrifuge pulls two G.

2 Facial distortion indicates strain at three G. There is a slight dimming of vision.

3 At four G facial distortion is marked; subject can not see out of corner of eyes.

4 At six G subject's sight is completely blacked out—his body weight is nearly ½ ton.

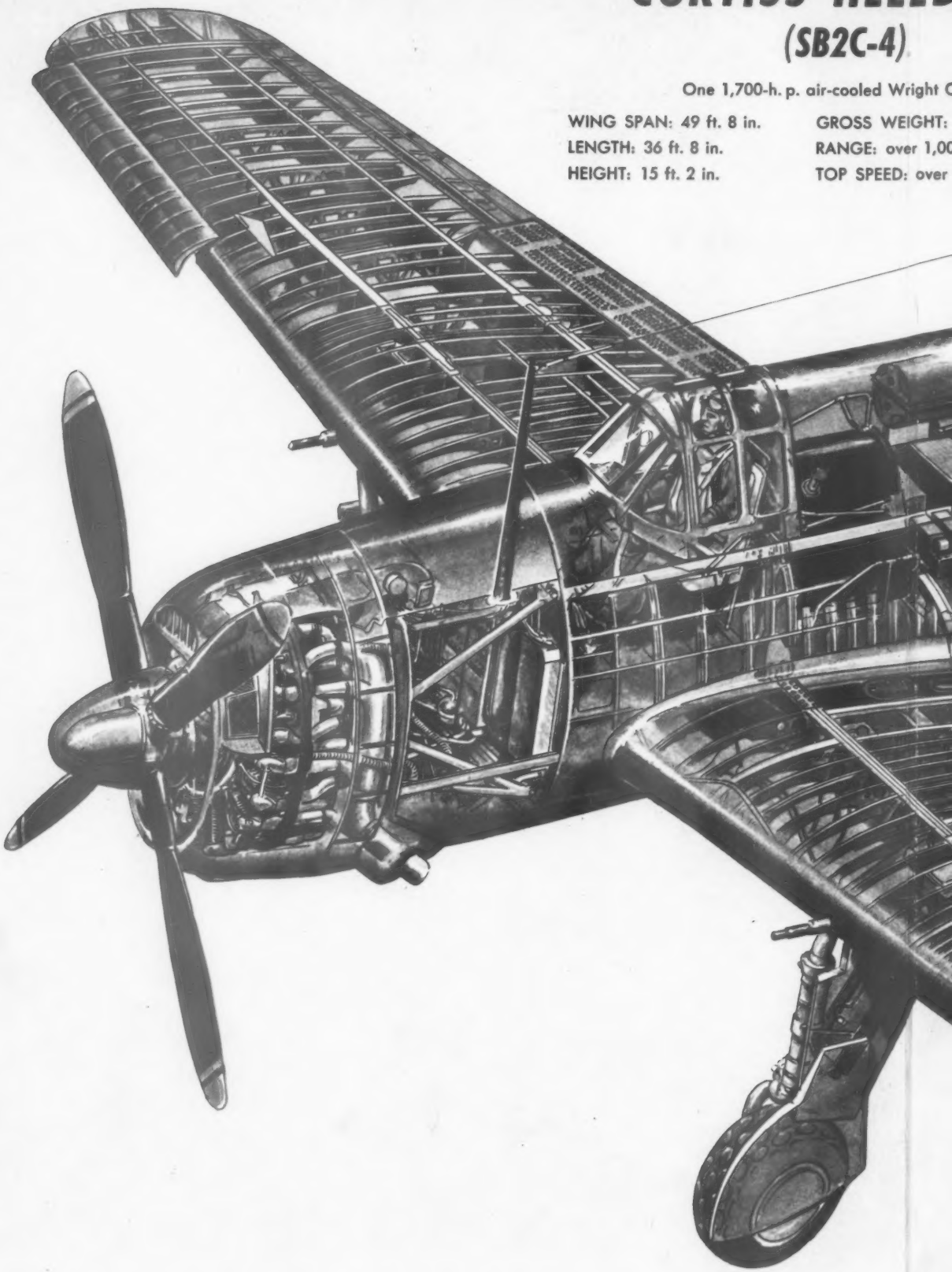
CURTISS HELLD

(SB2C-4)

One 1,700-h. p. air-cooled Wright C

WING SPAN: 49 ft. 8 in.
LENGTH: 36 ft. 8 in.
HEIGHT: 15 ft. 2 in.

GROSS WEIGHT:
RANGE: over 1,00
TOP SPEED: over



IELLDIVER
C-4)

oled Wright Cyclone

SS WEIGHT: approx. 14,000 pounds

GE: over 1,000 miles

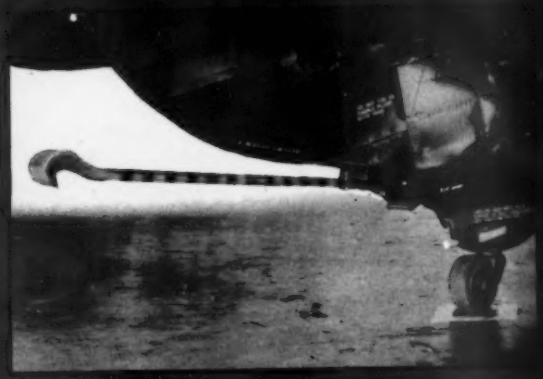
SPEED: over 250 m.p.h.

FLYING
CUTAWAY

by

REYNOLD BROWN and EARL F. CLELAND

© FLYING, SEPTEMBER, 1945

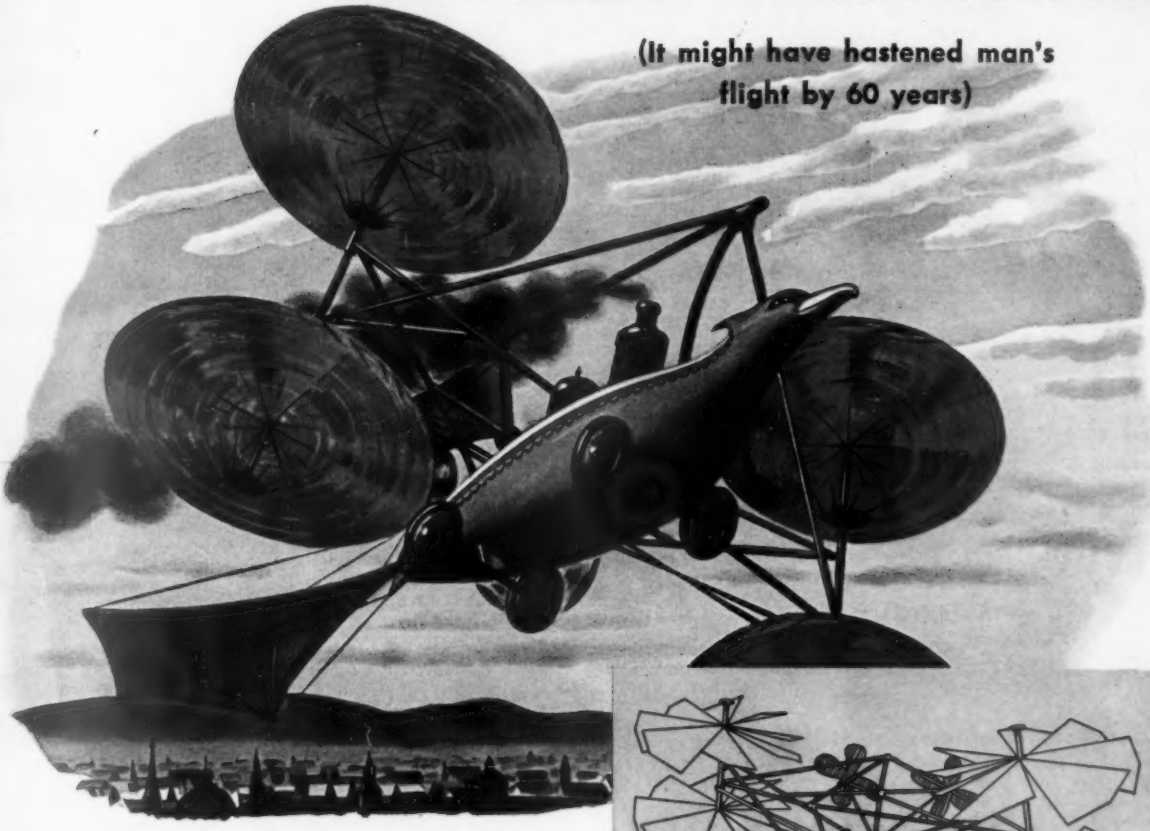


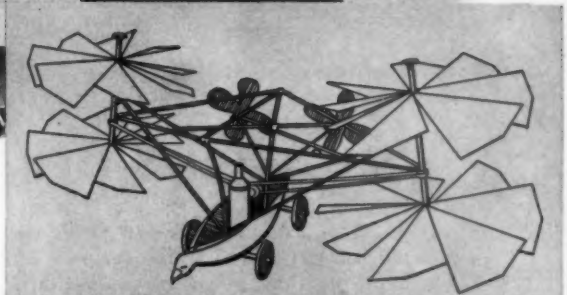
OTHER VIEWS OF THE HELLDIVER

ALTHOUGH a later modification (the SB2C-3) already has gone into service, the version of the Helldiver featured here (SB2C-1) is the one most widely used in combat. Differences between the Four and Five, although slight as far as the external appearance of the Helldiver is concerned, cannot be discussed for security reasons. The Four comes from a long line of Helldivers, the first SB2C flew in December 1940. This version has continually been reworked since today it is the deadliest dive bomber in the world. Armament of the Four-for instance, includes five tons of bombs, two 20-mm. cannon in the wings, two .30-cal. machine guns in the nose, another pair and rocket launchers under the wings. Some 1,100 Navy Helldivers were built under subcontract by Fairchild at Canoga (SB2) and by the Canadian Car and Foundry Co. (SBW). In the future, Helldiver production will be concentrated at the Curtiss factory in Columbus, O.

SIR GEORGE CAYLEY'S STRANGE HELICOPTER

(It might have hastened man's flight by 60 years)





In 1840, Sir George Cayley designed the machine above with two steam-driven propellers and double-tiered, rotating wings (set at an angle of incidence) on each side of the fuselage. Modern authorities believe that, if constructed, Cayley's design might actually have flown.

COMPARE today's ocean-spanning plane with Cayley's helicopter. Compare your sky trip today with the Wright brothers' flight of 284 yards at Kitty Hawk.

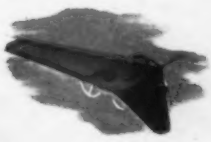
Man's air triumphs are triumphs in a peculiar battle — a battle of *Lift* versus *Drag*. A fight between *Lift* caused by air passing around a wing and *Drag* created by resistance of air to the plane's passage.

Northrop has been in the foreground of the battle for many years. There's the multicellular, internally-braced wing, Northrop pioneered in 1929. The stressed-skin wing built entirely of metal was a Northrop achievement of 1930. Today's high-altitude flying was pioneered by experiments in a Northrop "Gamma" of 1934. Double split dive flaps and retractable ailerons were 1935-1942 contributions.

Further to increase Lift and reduce Drag is a continuing project at Northrop. We have set our sights at still more efficient propulsion, and at designs like the Northrop Flying Wing, in which nearly all elements will contribute to Lift. Northrop Aircraft, Inc., Northrop Field, Hawthorne, California.

Creators of the ***Black Widow***

P-61 Night Fighter and the ***Flying Wing***



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Luxury & Safety

. . . are yours in the sporty new *Swift*

You will be proud of your new ***Swift*** with it's smart styling and inviting comfort. There is plenty of room for two six-footers in the spacious cabin . . . upholstered in rich, grained leatherette in your choice of red, blue, or green . . . durable and resistant to water and sun. Cabin trim harmonizes with upholstery. Hardware is chromium plated.

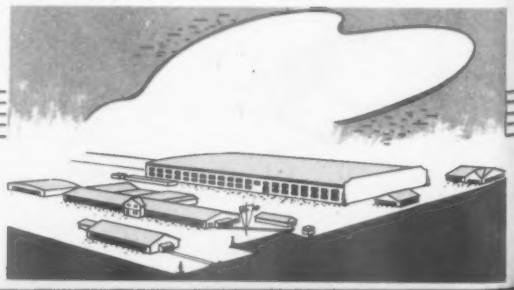
Body conforming seats are deeply padded . . . providing luxurious comfort and freedom from fatigue on long flights . . . an important feature, considering the ***Swift's*** 600 mile cruising range.

Ash trays, glove compartment, cabin heater, and cabin air vent are standard equipment, and the standard 12 volt battery is ample to handle 2-way radio, landing and navigation lights, and other electrical accessories. Ample luggage compartment behind the seats is easily accessible.

Easy to Buy . . . Thrifty to Fly

When you *see* the sporty new ***Swift*** and fly it yourself, you will discover many other refinements thoughtfully provided for your comfort and safety. We anticipate that your new ***Swift*** will soon be available through the dealer in your territory.

The Swift



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Designers and Manufacturers of

Improved Pyrotechnic Signaling Devices

In Quantity Production for the Armed Forces

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AN-MARK 1 MOD 1
Patent Applied For

Replacing outmoded "stick" rockets on all ships under the American Flag

PISTOL ROCKET SIGNALS
MARK 3 MOD 0
Patent Applied For

A NORTHROP BLACK WIDOW AT ITS PACIFIC ISLAND BASE. NOTE LIGHTNINGS IN BACKGROUND.

...and it'll be an *all-metal* SILVAIRE for me when I buy my own!

Flyers who are slapping Japs out of the clouds are not risking their lives in inferior aircraft . . . for nearly every Allied plane in the air today is all-metal.

Experienced pilots know that all-metal construction assures greater built-in strength, added durability. All-metal planes possess longer service life . . . provide added safety. What's more, streamlined all-metal contours give precious extra miles per hour.

Because all-metal construction offers so many advantages, look first to Luscombe, builder of the renowned SILVAIRE, pioneer all-metal light plane.

When conditions permit, Luscombe will offer you striking new SILVAIRES—inexpensive to buy, economical and safe to operate, suited to business or pleasure. Send for a *free copy* of illustrated booklet describing the SILVAIRE, mail coupon today.

UNTIL OUR WAR JOB IS FINISHED, *we'll continue to utilize our vast experience in all-metal fabrication of vital parts and sub-assemblies for many famous United Nations' fighter planes. When peacetime production again is resumed, beautiful new* SILVAIRES *will take to the skies . . . even finer planes than those that carried the name* SILVAIRE *to fame before the war.*

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AMERICA'S FIRST **ALL-METAL** PERSONAL PLANE

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☐ I'm interested in a SILVAIRE dealership.

Name .....

Street..... City.....

AN ARMY DOUGLAS SKYMASTER JUST AFTER TAKING OFF FOR AN OVERSEAS FLIGHT.

TWO-PLACE PIPER PT HAS 130-H.P. FRANKLIN, CRUISES AT 135 M.P.H.

Storage and repair of planes at the airport are necessary parts of aircraft sales organizations.

The Lightplane Dilemma . . .

Even if aircraft sales should skyrocket, the most successful selling organizations must tie in with fixed base operations.

By
LYNN L. BOLLINGER

This is the second and concluding chapter of what we believe to be one of the most important articles on the problems confronting distribution of lightplanes written in recent years. The author is assistant professor of business administration, Harvard Graduate School of Business Administration, and is a former fixed-base operator. This article first appeared in the Winter, 1945, issue of the Harvard Business Review—Ed.

A REVIEW of aviation history should be sobering to those who believe mass private flying is "just around the corner." Hopeful analogies between the growth of the automobile industry and the growth of the private aircraft industry for several decades have lured (and lost) many millions of dollars from enthusiasts seeking to develop the coming Ford-of-the-air. Not only were publications at the end of World War I replete with optimistic predictions, but as far back as 1915, according to John Frederick in *Commercial Air Transportation*, "the Aero Club of America became the vigorous advocate of the establishment of a chain of landing fields across the country, following the example set by the good-roads campaign that had had such success in paving the way for popular use of the automobile in the previous decade."

In a scholarly study of the private airplane market completed in 1931, Charles I. Gragg and Malcolm P. McNair observed that "the conscious and subconscious realization that these desires (aspirations for flight) are well-nigh universal may suffice to explain the otherwise almost incomprehensible tendency of producers and investors to overestimate the aggregate market for aircraft." They further reported that "by the end of 1928 . . . it was not unusual to hear those intimately connected with the industry prophesy sales of from 10,000 to 20,000 airplanes during 1929 alone." The same study presented the following "more cautious and more explicitly qualified . . . conclusion reached in 1930 by the advertising department of the Curtis Publishing Company:

"'If through the autogiro or some other principle, it comes about within the next five years that planes, when

they lose speed, will settle to the ground without damage, if they can be taken safely into and out of a four-acre lot and if a person with average mechanical training can in a short time at small expense learn to fly a plane safely and if, furthermore, planes are sold at prices comparable with automobile prices, considering number of passengers and grade of construction, a total within 10 years of 250,000 privately owned and operated planes—one to every 100 families—seems to us quite possible. It does not seem to us probable that airplanes will ever be so universally owned as automobiles, but it does seem to us not impossible that if the developments mentioned materialize, within 15 years there should be 1,000,000 privately owned planes in operation with an annual market of 250,000.' "

In 1930 there were, according to reports by the Civil Aeronautics Authority, 9,218 private airplanes in the country. Of these, however, only about 5,200 were owned by private individuals for personal flying purposes, including "flying in connection with a business." The remainder were used for flight instruction, aerial advertising and miscellaneous commercial operations. By 1940, in contrast with the 250,000 "cautious" 10-year expectation cited in the quotation above, the total of private planes in operation was 16,903. This figure, however, had been recently inflated by the Government-financed Civilian Pilot Training Program, started in 1939. In 1938, the last year not affected by the CPT Program, the total was only 10,718.

An attractive downtown display room, such as this Silvaire is occupying, can attract buyers, but sales must also be tied in with an airport for demonstration flights and service.

An analysis of the sales of a major producer of the small, two-place, lightplanes, which made up the vast bulk of the total, showed less than 20 per cent owned by "domestic and personal owners" at the end of 1942. The biggest user of these planes was the "domestic fixed-base operator," who appeared to account for almost 80 per cent of the total. There is thus strong evidence to suggest that in 1940 the number of airplanes owned by individuals for actual personal flying purposes was little if any larger than in 1930. Even discounting the effect of the depression, the total number of registered private planes in the country during the decade from 1929 to 1939 was surprisingly static. Starting in 1939 under the stimulus of the Government CPT Program the number of so-called private airplanes jumped to an all-time peak of 24,124 in 1941. Prior to the CPT Program, however, the peak annual production had been 2,042, in 1937. The 1941 production estimate, which included a preponderant number of trainers for the Government progam, was 7,700.

Despite the disillusioning history of private flying, those who are intensively studying its potentialities today advance convincing reasons for believing that a sharp expansion is this time truly "just around the corner." The dangers and obstacles as well as the costs should steadily decrease. Though the post-war airplane may not be radically different in over-all performance and cost, important factors independent of the airplane itself are increasing its advantages. Major among these is the increasing number of landing fields. Probably the most important single change affecting the market, however, is the great increase during the war period in the number of people, including a substantial number connected with wartime aviation, who accept and look forward to flying as a normal part of their own activity. The relative importance of this factor may well determine whether those experts who foresee a 100,000 annual market within a few years are more nearly correct than those who believe 10,000 to be a realistic maximum.

Up to the present time the airplane obviously has not offered the average citizen practical transportation even remotely comparable to the automobile. Furthermore, the post-war private airplane will have much the same appeals and disadvantages as its predecessors—despite the fact that the mechanics of flying are being simplified, the safety of the airplane is being steadily improved, and the initial cost may be reduced.

For a number of years to come private flying may be expected to fall more in the class of an expensive luxury with an appreciable hazard factor. Although many individuals of relatively low income often acquire airplanes, their purchases are frequently secondhand and even then ownership may last only during a relatively short period of disillusionment about expenses involved.

The best prospective customers for moderate-priced, two-place, personal planes are found in that small proportion of the population which can afford to spend roughly $1,000 a year on a time-consuming hobby. For people in this economic class, the invalidation of regular life insurance policies, together with high extra premiums for coverage when flying, often constitutes an objection more serious than the hazard itself. Furthermore, the complex art of navigation and the complications of bad weather remain even with spin-proof, easy-to-fly airplanes. While additional airway facilities and new technical developments will tend to minimize the difficulties and hazards of cross-country flying, the foolproof air-flivver for the general public still appears many years away.

The private airplane has a triple basis of appeal, namely, pride, recreation, and utility. The relative importance of these appeals is continuing to shift. In the early days of flying, pride was probably the chief incentive—the desire to be considered daring and different. The pilot was usually a local hero and frequently was not averse to cultivating this reputation. As flying has become more commonplace and also safer, it has developed a genuine recreational appeal. The skills required and the very complexities which prevent its yet being practical as everyday transportation add a certain zest and challenge to the sport. Flying combines many of the attractions of skiing, yachting and mountain climbing. Especially in the land-locked flatness of the midwest, flying offers an exhilarating escape from the monotony and routine of standardized American Main Street.

A survey by the Civil Aeronautics Authority in 1940 showed that, of the student pilots who took up flying "for the purpose of learning to fly privately, pleasure and not business was the principal contributing factor accounting for

(*Continued on page* 96)

Have You Seen?

New U. S. planes are, top to bottom, Eshelman two-place Winglet with 110-m.p.h. cruising speed and 635-mile range; model of four-place Skylark Skycraft with pusher engine, and simplified-control Landgraf helicopter undergoing AAF test.

To be tested soon is experimental one-man "Hoppicopter" of Horace T. Pentecost, Seattle. Its 20-h.p. engine drives the counter-rotating airfoils.

Messerschmitt Me-410 captured by Russians is a 22,000-pound fighter-bomber with top speed of 395 m.p.h. and 50-mm. cannon for attacking tanks.

HAVE YOU SEEN?

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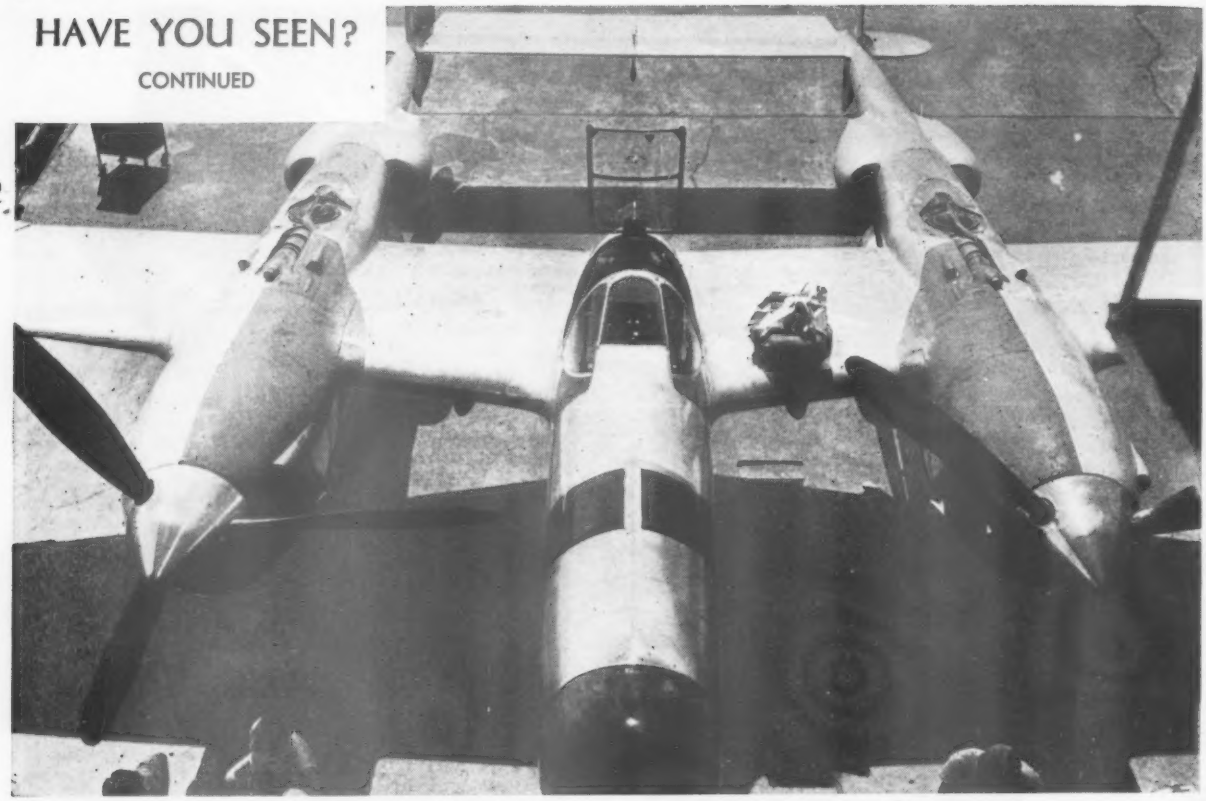
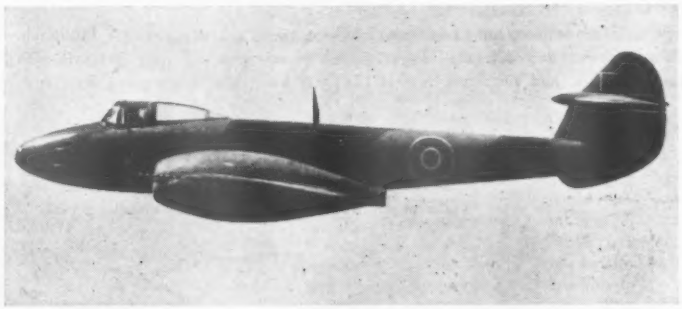
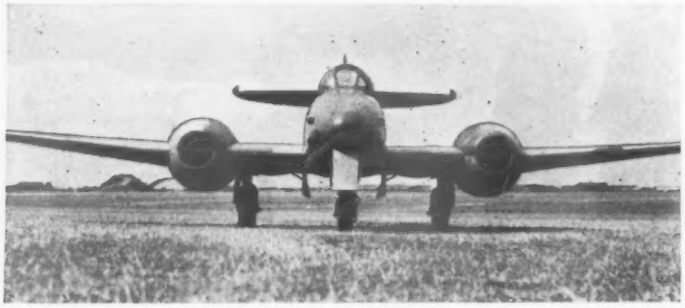


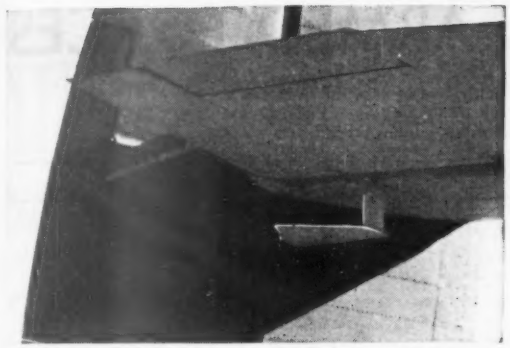
Two-man Pathfinder version of Lightning has standard bombing and navigation instruments plus special equipment in elongated nose used to pin-point enemy targets when visibility is poor. The Pathfinders lead other formations, aim bombs for entire bombing group.

New Hamilton Standard square-tipped prop for Mustangs, right, has more area than paddle-bladed prop.



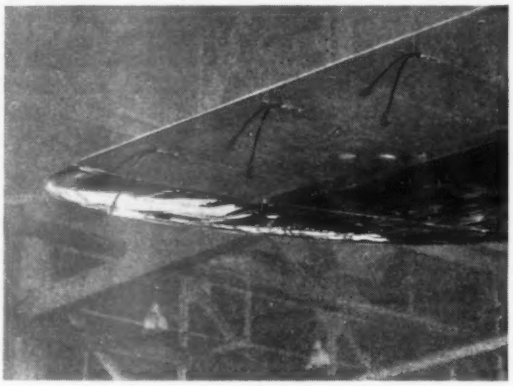
The British-built twin-jet Gloster Meteor fighter is the first Allied jet aircraft to see action against the enemy. Used against German V-1 flying bombs, it proved much faster than the intermittent duct jet buzz-bombs. Called "squirts" by RAF pilots, Meteors are powered by two Welland or Derwent engines developed from Air Commodore Whittle's turbo-jet design. Span is 43 feet, length 41 feet, height 13 feet, wing area 374 square feet.





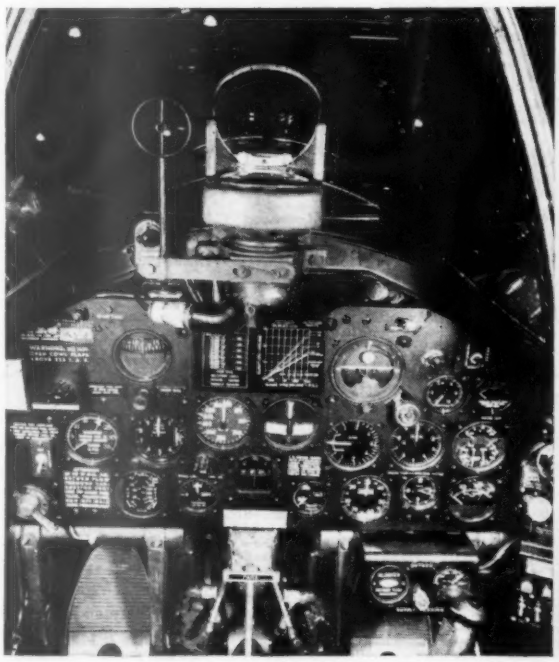
Small right-angled attachment between horizontal and vertical stabilizers of Martin Mariner corrects for oscillation of the vertical stabilizer during some conditions of flight.

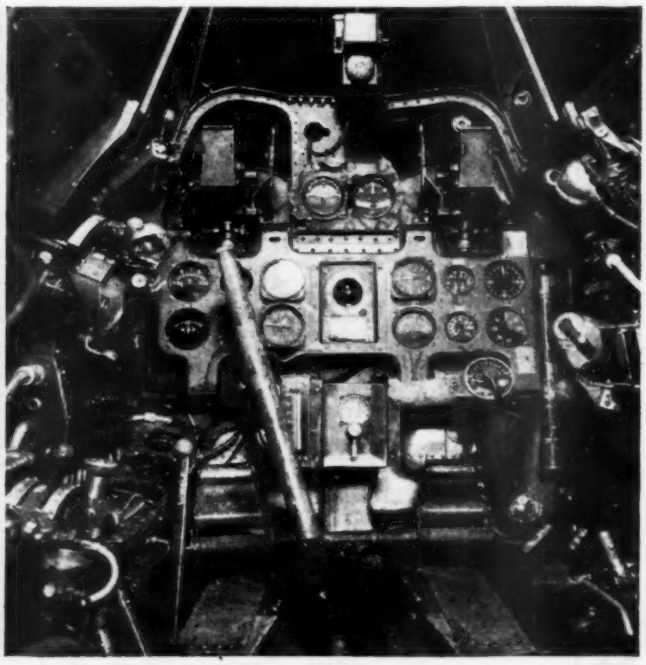
Three conducting cotton wicks on end of each B-29 aileron discharge static and reduce plane's radio interference. Other static dischargers are on rudder, elevator and stabilizer tip.



THREE NEW BRITISH COMMERCIAL PLANES

The pressurized Avro Tudor I (top) is a four-engined luxury airliner cruising at 296 m.p.h. with 12 or 24 passengers. Center is the short-range (450 miles) Miles Aerovan, designed for freight or passengers and cruising at 110-115 m.p.h. The De Havilland Dove, lower, is being built for feeder operation with eight to 11 passengers.





Well-placarded Thunderbolt cockpit (left) shows inferiority of Jap hand-cranked, trigger handle requires pilot's hand off throttle to fire is poor compared with newer type on Thunderbolt. Jap plane panel

Hamp equipment (right). Latter's cowl flaps and oil shutters are 7.7-mm. cowl-mounted machine guns. Hamp's old type gunsight lacks turbo speed dial, oxygen regulator, has multiple gas gauges.

AIRCRAFT OF THE U. S. ARMED FORCES

This is believed to be the most complete releasable list of aircraft in use by the United States armed forces in this war that has ever been compiled. It was assembled by the editors of FLYING with the assistance of the Army Air Forces and the Navy. A few still secret combat aircraft are not listed.

Army Desig.	Navy Desig.	Popular Name	Designer	Remarks
B-17	.....	Flying Fortress	Boeing	Production now tapering off.
B-18	.....	Bolo	Douglas	Two 830-h.p. Wrights.
B-19	.....	.....	Douglas	Experimental heavy bomber, one built.
XB-19A	.....	.....	Douglas	Same as B-19 but with four 2,600-h.p. Allisons.
B-20	.....	.....	Boeing	Never built.
XB-21	.....	.....	North American	Projected high altitude bomber; dropped.
XB-22	.....	.....	Douglas	Improved version of B-18; dropped.
B-23	.....	Dragon	Douglas	Obsolete but still used.
B-24	PB4Y	Liberator	Consolidated	Four 1,200-h.p. P. & W.'s.
B-25	PBJ	Mitchell	North American	Two 1,700-h.p. Wrights.
B-26	JM	Marauder	Martin	Two 2,000-h.p. P. & W.'s.
XB-27	.....	.....	Martin	Never built.
XB-28	.....	.....	North American	Pressurized medium bomber; project suspended.
B-29	.....	Superfortress	Boeing	High level super bomber.
B-30	.....	.....	Lockheed	Designation cancelled.
B-31	.....	.....	Douglas	Designation cancelled.
B-32	.....	Dominator	Consolidated	High level super bomber.
XB-33	.....	.....	Martin	Four-engined bomber; cancelled.
B-34	PV-1	Ventura	Lockheed	Two 2,000-h.p. P. & W.'s.
XB-39	.....	Superfortress	Boeing	Four 2,600-h.p. Allisons.
YB-40	.....	Flying Fortress	Boeing	Guns only.
XB-41	.....	Liberator	Consolidated	Guns only.
.....	PBY	Catalina	Consolidated	Two 1,200-h.p. P. & W.'s.
.....	PBY-5A	Catalina	Consolidated	Amphibious version, retractable gear.
.....	PB2Y	Coronado	Consolidated	Four 1,200-h.p. P. & W.'s.
B-24N	PB4Y-2	Privateer	Consolidated	Single-tailed Liberator.
.....	P4Y	Corregidor	Consolidated	Only one; not in operation.
.....	PBN	Catalina	Consolidated	Built in NAF".
.....	PV-1	Ventura	Lockheed	Two 2,000-h.p. P. & W.'s.
.....	PV-2	Harpoon	Lockheed	Developed from Ventura.
.....	PBM	Mariner	Martin	Two 1,500-h.p. Wrights.

ATTACK BOMBERS

A-20	BD	Havoc	Douglas	Two 1,600-h.p. Wrights.
A-21	.....	.....	Stearman	Two 1,400-h.p. P. & W.'s.
A-22	.....	Maryland	Martin	Two 1,200-h.p. P. & W.'s.
A-23	.....	.....	Martin	Two 2,200-h.p. engines; cancelled.
A-24	SBD	Dauntless	Douglas	Production completed.
A-25	SB2C	Helldiver	Curtiss-Wright	Army version of Curtiss Helldiver.
A-26	.....	Invader	Douglas	Two 2,000-h.p. P. & W.'s.
A-27	.....	.....	North American	Two 1,000-h.p. Wrights.
A-28	PBO	Hudson	Lockheed	Two 1,200-h.p. P. & W.'s.
A-29	PBO	Hudson	Lockheed	Two 1,200-h.p. Wrights.
A-30	.....	Baltimore	Martin	Used mainly by British.
A-31	.....	Vengeance I	Consolidated	One 1,700-h.p. Wright.
XA-32	.....	.....	Brewster	Experimental dive bomber.
A-33	.....	.....	Douglas	.....
A-34	SB2A	Buccaneer	Brewster	Out of production.
A-35	.....	Vengeance II	Consolidated	One 1,700-h.p. Wright.
A-36	.....	Mustang	North American	Erroneously called "Invader."
A-37	.....	.....	Hughes	Only one built.
A-38	.....	.....	Beech	Two 2,250-h.p. P. & W.'s.
A-39	.....	.....	Fleetwing	Only two built.
A-40	.....	.....	Curtiss-Wright	Only one built.
.....	SB2C	Helldiver	Curtiss-Wright	One 1,600-h.p. Wright.
.....	SBF	Helldiver	Curtiss-Wright	Built by Fairchild in Canada.
.....	SBW	Helldiver	Curtiss-Wright	Built by Canadian Car & Foundry.
.....	SB2A	Bermuda	Brewster	One 1,700-h.p. Wright.
.....	SBD	Dauntless	Douglas	Out of production.
.....	SB2D	Destroyer	Douglas	Only four built.
.....	TBD	Devastator	Douglas	Obsolete.
.....	TBF	Avenger	Grumman	One 1,700-h.p. engine.
.....	TBM	Avenger	Grumman	Built by General Motors.
.....	SB2U	Vindicator	Vought	Obsolete.
.....	TBY	Seawolf	Chance Vought	Built by Consolidated Vultee.

FIGHTERS

XP-37	.....	.....	Curtiss	Low-wing fighter
P-38	.....	Lightning	Lockheed	Two 1,725-h.p. Allisons.
P-39	.....	Airacobra	Bell	Now out of production.
P-40	.....	Warhawk	Curtiss	Production now stopped.
XP-41	.....	.....	Seversky	P-35 with different engine, 2-stage supercharger.
XP-42	.....	.....	Curtiss	Similar to P-36A except for long nose, engine, prop.
P-43	.....	Lancer	Republic	One 1,200-h. p. P. & W.
XP-44	.....	.....	Republic	Never built.
P-45	.....	.....	.....	Designation cancelled.
XP-46	.....	.....	Curtiss	.....
XP-47	.....	Thunderbolt	Republic	Version never built.
P-47	.....	Thunderbolt	Republic	P. & W. 2,000-h.p. engine.
P-47A	.....	Thunderbolt	Republic	One 1,200-h.p. Allison.
XP-48	.....	.....	Douglas	Designation cancelled.
XP-49	.....	.....	Lockheed	Similar to P-38 but with Continental engines.
XP-50	XF5F	Skyrocket	Grumman	Twin-engined fighter.
P-51	.....	Mustang	North American	Merlin and Allison engines.
XP-52	.....	.....	Bell	Proposed plane never built.
P-53	.....	.....	Curtiss	Cancelled. Continental 1,000-h.p. engine.
XP-54	.....	.....	Vultee	One 1,600-h.p. Lycoming.
XP-55	.....	Ascender	Curtiss	Tail-first, pusher-type plane flying wing; destroyed.
XP-56	.....	.....	Northrop	Magnesium plane, not to be produced. Flying wing.
XP-57	.....	.....	Tucker	Cancelled.
XP-58	.....	.....	Lockheed	Two 2,000-h.p. P. & W.'s.
P-59	.....	Airacomet	Bell	Twin GE jet engines.
YP-60	.....	.....	Curtiss	High altitude fighter, built and discontinued.
P-61	.....	Black Widow	Northrop	Night fighter, two P. & W. 2,000-h.p. engines.
XP-62	.....	.....	Curtiss	Only two built.
P-63	.....	Kingcobra	Bell	Allison 1,200-h.p. engine.
P-64	.....	.....	North American	Only six built; obsolete.
XP-65	.....	.....	Grumman	Project cancelled.
P-66	.....	Vanguard	Vultee	P. & W. 1,200-h.p. engine.
XP-67	.....	.....	McDonnell	Built and project dropped.
XP-68	.....	.....	Vultee	Project cancelled.
XP-69	.....	.....	Republic	Project cancelled.
P-70	.....	Havoc	Douglas	Night fighter version of A-20.
P-71	.....	.....	Curtiss-Wright	Project cancelled.
P-73	.....	.....	.....	Never assigned.
P-74	.....	.....	.....	.....
XP-75	.....	.....	General Motors	Eight built, project dropped.
P-76	.....	.....	Bell	Project cancelled.
XP-77	.....	.....	Bell	All-wood; Ranger engine.
P-78	.....	.....	North American	Designation cancelled (became P-51B).
P-79	.....	.....	.....	.....
P-80	.....	Shooting Star	Lockheed	Single jet engine.
P-322	.....	Lightning	Lockheed	.....
P-400	.....	Airacobra	Bell	.....
.....	F2A	Buffalo	Brewster	One 1,200-h.p. Wright.
.....	XFD	.....	Douglas	Details not available.
.....	F4F	Wildcat	Grumman	P. & W. 1,200-h.p. engine.
.....	F5F	Skyrocket	Grumman	Twin-engined fighter, dropped.
.....	F6F	Hellcat	Grumman	One 2,100-h.p. P. & W.
.....	F7F	Tigercat	Grumman	Two 2,100-h.p. P. & W.'s.
.....	F8F	Bearcat	Grumman	Based on Wildcat.
.....	FM	Wildcat	Grumman	Built by General Motors; same as F4F-8.
.....	F4U	Corsair	Vought	One 2,000-h.p. P. & W.
.....	F3A	Corsair	Vought	Made by Brewster.
.....	F6	Corsair	Vought	Made by Goodyear.

TRANSPORT AND UTILITY CARGO

C-33	.....	.....	Douglas	DC-2; has two Wright 750-h.p. engines.
C-34	.....	.....	Douglas	Another version of C-33.
C-35	.....	.....	Lockheed	Based on Lockheed Model 10-A (Electra).
UC-36	.....	.....	Lockheed	Version of the Electra.
C-37	.....	.....	Lockheed	Version of the Electra.
C-38	.....	.....	Douglas	Commercial DC-3.
C-39	.....	.....	Douglas	Hybrid; had fuselage of DC-2, wings and tail of DC-3.
C-40	.....	.....	Lockheed	Model 12.
C-41	.....	.....	Douglas	Version of commercial DC-3.
C-42	.....	.....	Douglas	Version of commercial DC-3.
UC-43	GB	Traveler	Beech	One 450-h.p. engine.
C-44	.....	.....	Messerschmitt	Commercial Me-108.
UC-45	JRB	Expeditor	Beech	Based on Beech 18-S.
C-46	R5C	Commando	Curtiss	Two 1,500-h.p. P. & W.'s.
C-47	R4D	Skytrain	Douglas	DC-3 version with large cargo door; two P. & W 1,200-h.p. engines
C-48	.....	.....	Douglas	DC-3 version.
C-49	R4D	Skytrooper	Douglas	DC-3 version with airline door, two Wright engines.
C-50	.....	.....	Douglas	DC-3 version.
C-51	.....	.....	Douglas	Similar to C-49D.
C-52	.....	.....	Douglas	Version of C-49.
C-53	R4D	Skytrooper	Douglas	DC-3 version with airline door; two P. & W.'s.
C-54	R5D	Skymaster	Douglas	DC-4 version with four P. & W. 1,350-h.p. engines.
C-55	.....	Commando	Curtiss-Wright	Version of C-46 (CW-20)
C-56	R50	Lodestar	Lockheed	Two 1,100-h.p. Wrights.
C-57	R50	Lodestar	Lockheed	Two 1,200-h.p. P. & W.'s.
C-58	.....	Bolo	Douglas	Converted B-18.
C-59	R50	Lodestar	Lockheed	Version of commercial 18-07.
C-60	R50	Lodestar	Lockheed	Various engines for different models of Lodestar.
UC-61	GK	Forwarder	Fairchild	One 165-h.p. Warner.
C-62	.....	.....	Waco	All-wood, twin-engined.
C-63	.....	Super Electra	Lockheed	Converted Hudson bomber.
UC-64	.....	Norseman	Noorduyn	One 600-h.p. P. & W.
C-65	.....	.....	Stout	90-h.p. pusher-type plane.
C-66	R50	Lodestar	Lockheed	Commercial 18-10.
C-67	.....	Dragon	Douglas	Converted from B-23 bomber.
C-68	.....	Skytrain	Douglas	Regular DC-3 interior.
C-69	.....	Constellation	Lockheed	Four 2,200-h.p. Wrights.
UC-70	GH	Nightingale	Howard	Jacobs & P. & W. engines.

Army Desig.	Navy Desig.	Popular Name	Designer	Remarks
UC-71	.....	Executive	Spartan	One P. & W. 450-h.p. engine.
UC-72	.....	.....	Waco	S. & E. cabin biplane.
C-73	.....	247-D airliner	Boeing	Two P. & W. engines.
C-74	.....	.....	Douglas	Four 2,400-h.p. P. & W.'s.
C-75	.....	Stratoliner	Boeing	Back on TWA airline.
C-76	.....	Caravan	Curtiss	Wooden plane; discontinued.
C-77	.....	.....	Cessna	Commercial DC-6A.
UC-78	JRC	Bobcat	Cessna	Trainer and transport.
C-79	.....	Captured Ju-52	Junkers	Three-engined planes captured from Germans.
UC-80	.....	.....	Harlow	Similar to Harlow PJC.
UC-81	.....	Reliant	Stinson	Similar to Stinson SR-8B.
C-82	.....	Packet	Fairchild	Two 2,100-h.p. P. & W.'s.
UC-83	.....	Cub Cruiser	Piper	Similar to civilian plane.
C-84	.....	DC-3	Douglas	Standard commercial DC-3.
UC-85	.....	Orion	Lockheed	Low-wing Lockheed 9D-2.
UC-86	.....	Forwarder	Fairchild	With Ranger engine.
C-87	RY	Liberator Express	Consolidated	Transport Liberator.
C-88	.....	.....	Fairchild	Version of Fairchild F-45.
C-89	.....	.....	Hamilton	Version of Hamilton H-47.
C-90	.....	.....	Luscombe	Version of Silvaire.
C-91	.....	.....	Stinson	Version of Stinson Model A.
C-92	.....	.....	Funk	Version of Funk Model B7S-L.
C-93	RB-1	Conestoga	Budd	Stainless steel; discontinued.
UC-94	.....	Airmaster	Cessna	Version of C-165 with Warner 145-h.p. engine.
C-95	.....	.....	Taylorcraft	Version of Taylorcraft BL-65.
UC-96	.....	.....	Fairchild	Similar to Model "71."
C-97	.....	Stratocruiser	Boeing	Based on Superfortress.
C-98	B-314	Clipper	Boeing	Pan American clipper planes.
C-99	.....	.....	Consolidated	Six-engined super transport (based on B-36).
UC-101	.....	Vega	Lockheed	Designation of the Vega 5-C.
UC-102	.....	.....	Rearwin	Based on Rearwin 9000-KR.
UC-103	.....	.....	Grumman	Based on Grumman G-32A.
C-104	.....	.....	Lockheed	Designation cancelled.
C-105	.....	.....	Boeing	Converted XB-15; only one.
C-106	.....	.....	Cessna	Two 500-h.p. engines.
C-107	.....	.....	Consolidated	Only one built.
XC-108	.....	.....	Boeing	Converted Fortress.
C-109	.....	Flying Tanker	Consolidated	Modified Liberator
.....	M-130	Clipper	Boeing	Pan American Clippers.
.....	PB2Y	Coronado	Consolidated	Four 1,200-h.p. P. & W.'s.
.....	R3D	.....	Douglas	Same as DC-5.
.....	JRF	Goose	Grumman	Two 450-h.p. P. & W.'s.
.....	J2F	Duck	Grumman	Wright 890-h.p. engine.
.....	J2F-6	Duck	Grumman	Built by Columbia Aircraft.
.....	J4F	Widgeon	Grumman	Coast guard version of J4F-1.
.....	JRM	Mars	Martin	Four 2,000-h.p. Wrights.
.....	PB2M	Mars	Martin	Production version of JRM.
.....	PBM-3R	Mariner	Martin	Transport version of bomber.
.....	JRS-1	.....	Sikorsky	Two 750-h.p. P. & W.'s.
.....	JR2S	Excalibur	Sikorsky	American Export Line planes.
.....	HE-1	.....	Piper	Two-place ambulance plane.

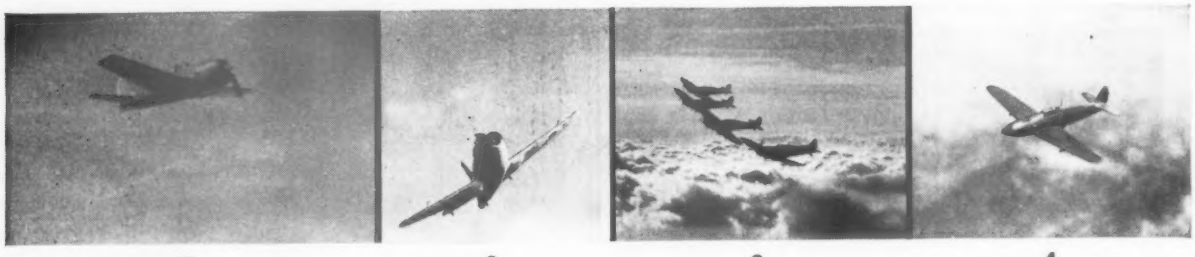
PRIMARY, BASIC AND ADVANCED TRAINERS

PT-13	N2S	Kaydet	Stearman	Lycoming 220-h.p. engine.
PT-14	.....	.....	Waco	Continental 220-h.p. engine
PT-15	.....	.....	St. Louis	Model PT-1W.
PT-16	.....	.....	Ryan	.....
PT-17	N2S	Kaydet	Stearman (Boeing)	Continental and Lycoming engines.
PT-18	.....	Kaydet	Stearman	Jacobs 225-h.p. engine.
PT-19	.....	Cornell I	Fairchild	One Ranger 175-h.p. engine.
PT-20	.....	Cornell	Ryan	125-h.p. engine.
PT-21	.....	.....	Ryan	Kinner 125-h.p. engine.
PT-22	NR	Recruit	Ryan	Kinner 160-h.p. engine.
PT-23	.....	Cornell	Fairchild	One 220-h.p. Continental.
PT-24	.....	.....	DeHavilland	Made in Britain—140-h.p. engine.
PT-25	NR	.....	Ryan	Lycoming 185-h.p. engine.
PT-26	.....	Cornell II	Fairchild	One 200-h.p. Ranger.
PT-27	.....	.....	Fleet	One 200-h.p. Ranger.
.....	NH-1	Nightingale	Howard	Similar to Howard D6A.
.....	N3N	No name	NAF*	One 235-h.p. engine.
.....	NE-1	Grasshopper	Piper	Similar to Piper liaison plane.
.....	N2T	Tutor	Timm	One 220-h.p. Continental.
BT-9	SNJ	Texan	North American	Similar to AT-6.
BT-10	.....	.....	North American	P. & W. 550-h.p. engine.
BT-11	.....	.....	Aircraft Research	Project discontinued.
BT-12	.....	Sophomore	Fleetwings	One 450-h.p. P. & W.
BT-13	SNV	Valiant	Consolidated	One 450-h.p. P. & W.
BT-14	.....	.....	North American	One 450-h.p. Wright.
BT-15	SNV	Valiant	Consolidated	One 440-h.p. Wright.
BT-16	.....	.....	Vidal	Modified B-13 (Valiant)
XBT-17	.....	.....	Stearman	Only one was built.
.....	SNC	Falcon	Curtiss	"Intermediate trainer".
AT-6	SNJ	Texan	North American	One 600-h.p. P. & W.
AT-7	SNB-2	Navigator	Beech	Pilot, co-pilot, 3 students.
AT-8	JRC-1	Bobcat	Cessna	Two 280-h.p. Lycomings.
AT-9	.....	Jeep	Curtiss	Two 280-h.p. Lycomings.
AT-10	.....	Wichita	Beech	Two 295-h.p. Lycomings.
AT-11	SNB-1	Kansas	Beech	Two 450-h.p. engines.
AT-12	.....	.....	Republic	One 1,065-h.p. engine.
AT-13	.....	Yankee Doodle	Fairchild	Two 550-h.p. P. & W.'s.
AT-14	.....	Yankee Doodle	Fairchild	Two 520-h.p. Rangers.
AT-15	.....	Crew Maker	Boeing	Two 600-h.p. P. & W.'s.
AT-16	.....	Harvard	Noorduyn	British-made.
AT-17	JRC-1	Bobcat	Cessna	Two Jacobs 225-h.p. engines.
AT-18	PBO	Hudson	Lockheed	Converted A-29 bomber.
AT-19	.....	Reliant	Vultee (Stinson)	One 280-h.p. Lycoming.
AT-20	.....	Anson	Avro	British twin-engined aircraft.
AT-21	.....	Gunner	Fairchild	Wooden trainer; also built by Bellanca and Robertson.
AT-22	.....	Liberator	Consolidated	Converted Liberator.
AT-23	JM-1	Marauder	Martin	Converted Marauder.
AT-24	.....	Mitchell	North American	Converted B-25.

Army Desig.	Navy Desig.	Popular Name	Designer	Remarks
LIAISON AND OBSERVATION				
L-1	.....	Vigilant	Vultee	One 300-h.p. Lycoming.
L-2	.....	Grasshopper	Taylorcraft	One 65-h.p. Continental.
L-3	.....	Grasshopper	Aeronca	.....
L-4	AE	Grasshopper	Piper	One 100-h.p. Lycoming.
L-5	OY	Sentinel	Stinson	One 190-h.p. Lycoming.
L-6	.....	Grasshopper	Interstate	Interstate Model S-1B.
L-7	.....	.....	Monocoupe	Built by Universal.
L-8	.....	.....	Interstate	Model 90.
L-9	.....	Voyager	Stinson	Based on Stinson 10A.
L-10	.....	.....	Ryan	Model SCW-145.
L-11	.....	Skyrocket	Bellanca	Model 31-50.
L-12	.....	Reliant	Stinson	Equivalent of Model SR-5A.
L-13	.....	.....	Stinson	Ambulance plane.
L-14	.....	.....	Piper	Cub with 125-h.p. engine.
O-25	.....	.....	Douglas	Wright engines.
O-47	.....	.....	North American	Similar to North American Model GA-15.
O-49	.....	Vigilant	Vultee	One Lycoming 300-h.p. engine (Redesignated L-1).
O-52	.....	Owl	Curtiss-Wright	One P. & W. 600-h.p. engine.
O-53	.....	Havoc	Douglas	Version of A-20.
O-56	.....	Ventura	Lockheed	Modified B-37.
O-57	.....	Grasshopper	Taylorcraft	One Continental 65-h.p. engine (Redesignated L-2).
O-58	.....	Grasshopper	Aeronca	Same as L-3.
O-59	NE	Grasshopper	Piper	Same as L-4.
O-62	.....	Sentinel	Stinson	Same as L-5.
OA-9	JRF-6A	Goose	Grumman	Two 450-h.p. P. & W.'s.
OA-10	PBY	Catalina	Consolidated	Two 1,200-h.p. P. & W.'s.
OA-11	.....	.....	Sikorsky	Destroyed.
OA-12	J2F-5	Duck	Grumman	One Wright R1820 engine.
OA-13	JRF	Goose	Grumman	Model G-21-A.
OA-14	J4F2	Widgeon	Grumman	Coast Guard version of G-44.
OA-15	.....	.....	Republic	One 240-h.p. engine.
.....	SOC	.....	Curtiss-Wright	Biplane, obsolete
.....	SC-1	Seahawk	Curtiss-Wright	New ship-based floatplane.
.....	SO3C	Seagull	Curtiss-Wright	Obsolescent.
.....	SON	No name	Curtiss-Wright	Built in NAF*.
.....	PB4Y-1P	Liberator	Consolidated	Photo-recon. version.
.....	JM-1P	Marauder	Martin	Target-towing and photog.
.....	OS2U	Kingfisher	Vought	One Wright 450-h.p. engine.
.....	OS2N	Kingfisher	Vought	Built in NAF*.
PHOTO PLANES				
F-1	.....	.....	Fairchild	Commercial Model 71.
F-2	.....	Kansas	Beech	Photo version of trainer.
F-3	.....	Havoc	Douglas	Photo version of A-20.
F-4	.....	Lightning	Lockheed	Photo version of P-38E.
F-5	.....	Lightning	Lockheed	Photo version of P-38E.
F-5E	.....	Lightning	Lockheed	Photo version of P-38J.
F-6	.....	Mustang	North American	Photo version of P-51.
F-7	PB4Y-1P	Liberator	Consolidated	Photo version of Liberator.
F-8	.....	Mosquito	De Havilland	Photo version of Mosquito.
F-9	.....	Flying Fortress	Boeing	Photo version of Fortress.
F-10	.....	Mitchell	North American	Photo version of B-25.
F-13	.....	Superfortress	Boeing	Modified B-29.
F-13A	.....	Superfortress	Boeing	Photo plane, six cameras.
GLIDERS AND HELICOPTERS				
TG-1	.....	.....	Frankfort	Commercial glider.
TG-2	.....	.....	Schweizer	Two-place training glider.
TG-3	.....	.....	Schweizer	Two-place training glider.
TG-4A	.....	Yankee Doodle Two	Laister-Kauffmann	Two-place trainer.
TG-5	.....	.....	Aeronca	Glider version of powered Aeronca Defender (L-3B).
TG-6	.....	.....	Taylorcraft	Three-place training glider (L-2B).
TG-7	.....	.....	.....	Polish-made.
TG-8	.....	.....	Piper	Three-place training glider (L-4B).
TG-9	.....	.....	Briegler	Glider.
TG-10	.....	.....	Wichita Engineering	Glider.
TG-12	.....	.....	Bowlus	Two-place training glider.
CG-1	.....	.....	Frankfort	Eight-place glider.
CG-2	.....	.....	Frankfort	Fifteen-place glider.
CG-3A	.....	.....	Waco	Cargo glider; gross weight 4,400 pounds.
CG-4A	.....	Haig	Waco	Cargo glider, gross weight 7,500 pounds.
CG-5	.....	.....	St. Louis	Eight-place glider.
CG-6	.....	.....	St. Louis	Fifteen-place glider.
CG-7	.....	.....	Bowlus	Eight-place glider.
CG-8	.....	.....	Bowlus	Fifteen-place glider.
CG-9	.....	.....	AGA	Thirty-place glider.
CG-10A	.....	.....	Laister-Kauffmann	Will carry six tons of aerial freight, 42-place.
CG-11	.....	.....	Snead	Thirty-place glider.
CG-12	.....	.....	York	Thirty-place glider.
CG-13A	.....	.....	Waco	Cargo glider, gross weight 16,765 pounds; 30-place.
CG-14	.....	.....	Chase	Fifteen-place glider.
CG-15A	.....	.....	Waco	Cargo glider, loading through nose, 15-place.
CG-16	.....	.....	General Airborne Tr.	Forty-two-place glider.
CG-17	.....	.....	Douglas	C-47 without engines.
XR-5	.....	.....	Sikorsky	Helicopter, 450-h.p. P. & W.
XR-6	.....	.....	Sikorsky	Helicopter built by Nash-Kelvinator.
YR-4	.....	.....	Sikorsky	Helicopter, 180-h.p. Warner.

*NAF is the abbreviation for Naval Aircraft Factory.

FOR IDENTIFICATION



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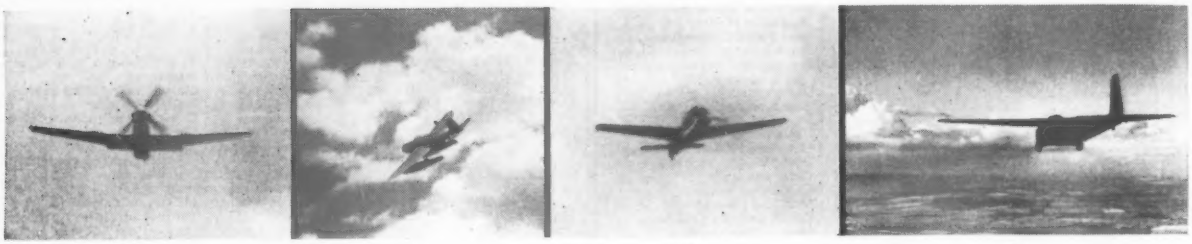
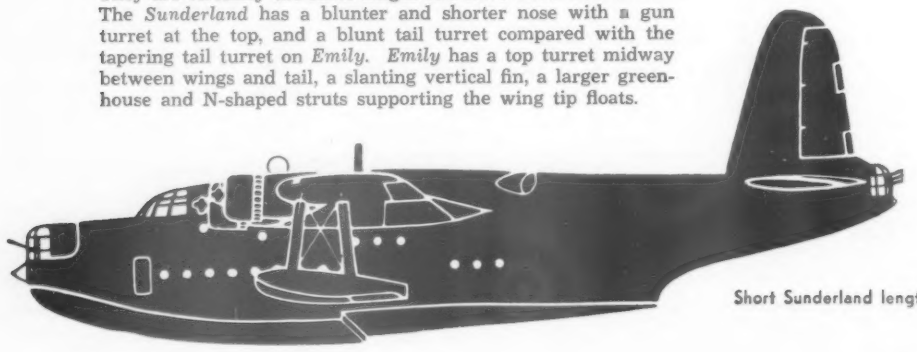


5 6 7 8

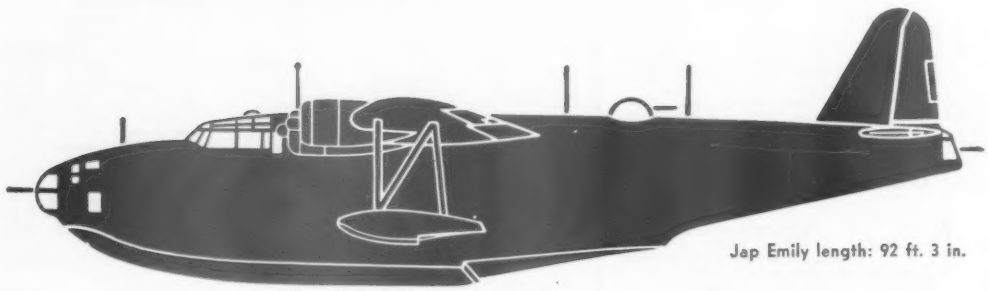
The planes are: 1. Grumman *Hellcat* (F6F-3); 2. Gloster *Meteor*; 3. Supermarine *Spitfires*; 4. Jap *Tony*; 5. North American *Mustang* (P-51); 6. Jap *Jake*; 7. Focke-Wulf Fw-190; 8. General Aircraft *Hamilcar* glider.

MISTAKEN IDENTITIES

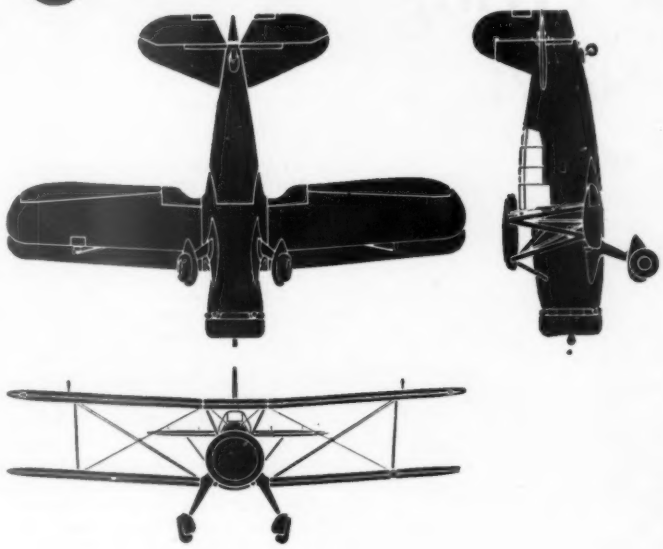
HERE are two more silhouettes (see last month's FLYING, page 52) of the Short *Sunderland* and the Jap *Emily*. From the side, these two planes are quite similar in silhouette and could easily be mistaken for each other in the Pacific area. They are virtually the same length and have other similarities. The *Sunderland* has a blunter and shorter nose with a gun turret at the top, and a blunt tail turret compared with the tapering tail turret on *Emily*. *Emily* has a top turret midway between wings and tail, a slanting vertical fin, a larger greenhouse and N-shaped struts supporting the wing tip floats.



Short Sunderland length: 85 ft. 4 in.



Jap Emily length: 92 ft. 3 in.

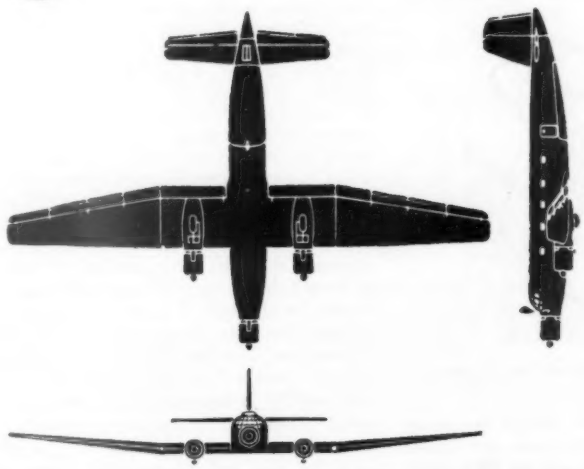


CURTISS SEAGULL (SOC)

The two-place Curtiss *Seagull* (SOC) has done yeoman service as a Navy scout observation plane and is still in use with a few units of the Pacific fleet, though being replaced by the new Curtiss *Seahawk* (SC-1). A biplane with external wing struts and wire bracing, the *Seagull* is powered with a 450-h.p. Pratt & Whitney *Wasp* which gives the wheel-geared version, pictured here, a maximum speed of 178 m.p.h. and the float version a maximum speed of 165 m.p.h. Wing span is 36 feet; fuselage length 26 ft. 10 in.; height 13 feet; gross weight 5,437 pounds; service ceiling 17,000 feet. It is used with either wheel gear or single float for battleship and cruiser catapult operations. Armament is two .30-caliber machine guns. It should not be confused with the SO3C also called *Seagull*.

CONSOLIDATED MODEL 37

Consolidated Vultee's Model 37 is the largest plane yet scheduled for production. It will weigh 320,000 pounds, be 182 feet long, have a wing span of 230 feet, height of 57 feet. Its six pusher engines will cruise it at speeds of 310 to 342 m.p.h. In silhouette, Model 37 is a remarkably clean airplane with long cigar-shaped fuselage, a single, high vertical fin and marked sweep-back on the leading edges of the wings, which end in round tips. It will seat 204 passengers, have lounges and rest rooms.



JUNKERS Ju-352

The Junkers Ju-352 transport appeared in at least two versions—one with Jumo-211 1,200-h.p. liquid-cooled engines and a second, depicted here, with three air-cooled 14-cylinder two-row BMW-801 engines of 1,600 h.p. each. In side view it is distinguished by its long snout-like nose housing one of the three engines. Its low wings show slight dihedral outboard of the engines. The leading edges are straight and there is marked taper on the trailing edges outboard of the engines. The Ju-352 is considerably larger than the three-engined Ju-52. It has a wing span of 115 feet and length of 80 ft. 7 in. Gun positions were fitted behind the cockpit, under the fuselage and in the tail.

I Learned About Flying From That!—No. 71

By Lieut. ROBERT E. CHURGIN

Pilot, USAAF, missing in action

His forced landing only rattled this pilot but when someone turned on his plane's radio he really blew up.

ONCE in every young pilot's life he believes himself to be a "hot-shot pilot." This can be verified by those "veteran flyers" with from 10 to 200 hours. I've told this story to 1,000 members (more or less) of our beloved Air Forces. Every time a new group of men joined our squadron, the conversation seemed to drift to crackups and forced landings.

That's where I came in. My roommate, Lieut. E. L. Comeau of West Springfield, Mass., always used the same routine. Very nonchalantly he would say, "Speaking of crackups, fellows, we have a pilot here who has had so many crash landings that we heard he is up for the Japanese D.F.C." Now I have had only two crackups, but Comeau's voice would come floating across the room, "Oh, Lootenant—Lootenant Churgin, come over here and tell the boys about the time you crashed into a cornfield."

After much horsing around, I'd finally tell the boys about the cornfield incident. For some reason, everyone thought it was funny. At that time I thought it was a sad event. I still do.

Before the Army Air Forces sends a cadet on a solo cross country, it gives him an extensive ground course on map reading and plotting. The cross country trip he will fly is given a thorough going over and actual photographs of the check

Comeau's voice floated over to me.

points are also passed around for study.

After the true course lines are drawn in, distance measured, and an ETA (estimated time of arrival) figured out, the cadet is ready for a dual cross country flight.

The instructor helps the cadet all he can on this trip and must be sure that Mr. Dumbjohn up in the front cockpit knows what he is doing. If the cadet gets off course, his instructor has him compare the surrounding terrain with his maps, determine his exact location and get back on course. Particular attention is paid to the ETA. On short cross country trips, a predetermined ETA is very accurate, but now and then some knucklehead forgets about it, like the cadet who flew 350 miles in a straight line, although his ETA for the turning point was one hr. 10 min.

After the flight is over, student and instructor discuss the trip and clear up any questions or problems the cadet may have. With these preparations complete, a group of us got ready for our solo cross country flight, a three-legged triangular course. We were to fly to Georgetown, Allendale, and back to our home base, Shaw Field, Sumter, S. C. As I walked out to my plane I decided to race around the course and try to beat the other boys. I almost did, too—but not quite! As it turned out, it took me exactly 29 days to get back to the flight line. But I'm getting ahead of myself now.

It was a beautiful day. I took off, circled the field as I climbed to my assigned altitude, and then headed for Georgetown. Carefully watching my check points, I landed at Georgetown five minutes ahead of schedule. Off I went to Allendale, stepping my speed up a trifle more. Again I checked all landmarks and made my heading corrections. I passed two of the boys on this leg and landed at Allendale without mishap. Now I was 15 minutes ahead of my ETA. Cross countries are easy, I thought. On the way back to Shaw Field I'll really open her up.

On this final leg, I saw Orangeburg, S. C., on my left and knew I was to the right of my course. I made a correction and relaxed—only 40 miles to go. After 20 minutes I decided I'd better start checking. It never occurred to me that I had passed the field without sighting it. Another 15 minutes passed before it dawned on me that I was lost! I followed a railroad which brought me to several small towns which I buzzed, vainly seeking a name on the water tanks and railroad stations. My gas was running low and I started to look for a suitable field in which to land. I was in the vicinity of Mullins, S. C., and the area there is mostly swamp land. I spotted a cornfield about 200 yards long, bordered by trees and high tension wires on both sides.

My engine began to cough every time I was in a bank, warning that my BT-13, affectionately called the Vultee *Vibrator*, was running out of gas. With a silent prayer I came in for a landing. I knew it would be close but was confident I would be all right if I used my head. I cleared the trees by at least a yard, cut my engine, levelled off, cut my ignition off and made a three-point landing. Then the prop hit a mound of dirt and over I went. It took me about three minutes to get out from under the plane. Outside of a few cuts and aching head, I was all

(*Continued on page* 144)

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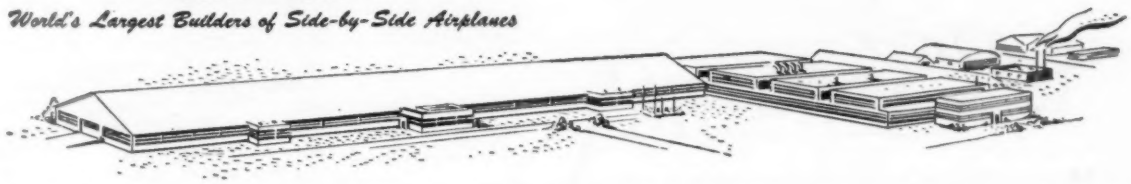


TAYLORCRAFT AVIATION CORPORATION • ALLIANCE, OHIO

Letters

SHARP EYES

Sirs:

Your well-done article, "Here's *How* to Run an Airport" (FLYING's July issue) had two errors that merit discussion. I've learned from experience *never* to operate any electrical device near a plane that is being refueled and never to hang tags on the adjustment knobs of instruments. Most pilots, in yanking them off, will bend or break the knob.

MALCOLM VON BEHREN

Washington, D. C.

Sirs:

I wouldn't want to operate a vacuum cleaner at the same time a plane is being fueled with high octane gas—you know; gas fumes, electrical sparks and a summer afternoon. Otherwise, "How *Not* To Run an Airport" was a splendid piece.

HENRY W. ROBERTS

New York, N. Y.

● Readers von Behren and Roberts have sharp eyes. Rather than take two separate pictures, Photographer Groehhoff took artistic license and combined the two operations in one picture—a combination which Owens Field wouldn't normally condone.—ED.

HOW NOT TO RUN AN AIRPORT

Sirs:

Your article on "How *Not* To Run An Airport" was, to put it mildly, timely and appropriate. I am one of the many individuals who practically have been thrown off airports by the calloused indifference of fixed-base operators. These same operators would probably protest long and loud that they never do such things, but as a consequence of their actions, I, like many others, just won't come back.

I'm thankful for your intestinal fortitude in championing the cause of private aviation. But don't let your effort stop with this one article—carry it through.

THOMAS P. OWENS
OPA Regional Placement Officer

New York, N. Y.

Sirs:

Your article on "How *Not* To Run An Airport" was good and certainly very timely.

BRUCE UTHUS, Director
CAA Aviation
Training Service

Washington, D. C.

Sirs:

Your exposures in "How *Not* To Run An Airport" of the lamentable conditions that private flying endures, is a needed, fine and constructive job.

DEVON FRANCIS
Popular Science

New York, N. Y.

Sirs:

I'm glad someone has finally gotten around to making a noise about the unspeakable conditions at small airports. A woman notices things more quickly than a man, and being a woman who has flown for years (unfortunately in rented planes) with one exception I have never found any small field that did not equal or exceed the vileness, carelessness and downright suicidal danger you illustrated. I believe an operator need not be a millionaire to keep things safe and sanitary.

MRS. HELENA S. PRICE

Westfield, N. J.

Sirs:

Your excellent airport stories in the June and July issues of FLYING have done private flying a service by pointing out the horrors of poorly-managed airports.

Airport Digest has summarized both articles. You have pointed out a specific problem and have gone to work on it with vigor. Congratulations.

NATIONAL AERONAUTIC ASSOCIATION
Constance Peterson

Washington, D. C.

WHAT THE CAA NEEDS

Sirs:

Secretary Wallace's article in the June issue of FLYING has every statement qualified by an "if" or a "but." I fail to see anything definite in what he has to say.

At a time when many CAA regulations are in the same class as the ancient law that required someone with a lantern to walk ahead of an automobile at night, what aviation needs is someone in Washington who knows the problems of the private plane owner and the small airport operator.

C. R. POWELL

East Sparta, O.

IS HOYT HOYLE?

Sirs:

After reading Hoyt's article, "Is The Stall Landing Obsolete," (May FLYING) we're of the opinion he is as all wet as a landing at sea. He can't be a pilot, for no pilot would write such malarky.

As pilots, we've witnessed many full-stall landings. If a pilot can stall in from six inches it's pure luck—from three feet is good, for the average stall landing is started much higher.

Perhaps his statements on wheel landings are correct but for his arguments against the stall landing, take away his pen and give him a rowboat.

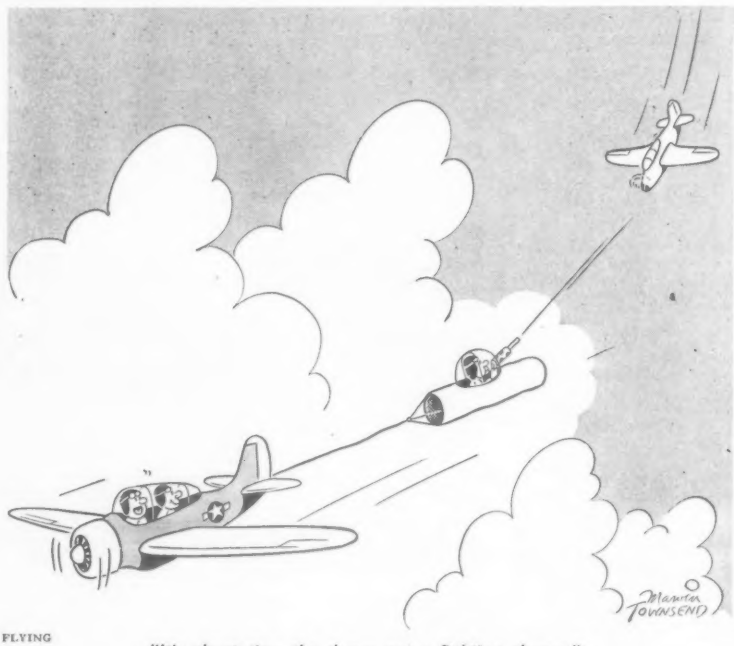
TWO MARINE PILOTS

Miramir, Calif.

● Here are a few facts on Author Hoyt's background: At present a Navy lieutenant commander, he soloed in 1933; Navy wings, 1936; flew F4B-4 Boeing fighters from U.S.S. Lexington, 1937-1938. Since then he has been a Naval flight instructor, CAA inspector, assistant to Director of Aviation Training, BuAer, Washington, and has written *Manual for Aviation Cadets*, and *Safety After Solo*, (McGraw-Hill).

He is an associate fellow, Institute of Aeronautical Sciences; a Quiet Birdman and has logged to date a total of 3,900 hours. Of this figure, 1,200 hours were

(*Continued on page* 146)



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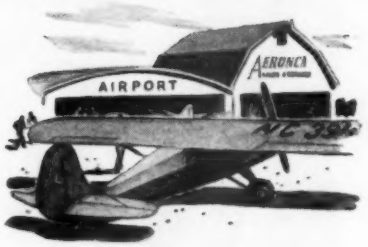
The word's been getting around about the planes themselves, too—the last word in engineering, easy to buy, easy to fly. Airminded people will look instinctively for the name "Aeronca" on a dealer's hangar. For further information,



send 10¢ to Aeronca Aircraft Corp., Dept. F-9, Middletown, Ohio, for a copy of "Aeronca—The Plane You'll Want to Fly."

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THE LIBRARY

THE COMING AGE OF ROCKET POWER, by G. Edward Pendray; published by Harper & Brothers, 49 East 33rd Street, New York, N. Y. in 1945. 244 pages. Price $3.50.

ROCKETS AND JETS, by Herbert S. Zim; published by Harcourt, Brace and Company, 383 Madison Avenue, New York 17, N. Y. in 1945. 326 pages. Price $3.

One of these books is a must for any reader who wants a layman's background and the latest releasable information on the exciting and important subject of rocket and jet propulsion. Of the two, the Zim book is slanted for a slightly younger audience while the Pendray book goes into more detail on technical developments. Both cover much the same ground—the history of rocket and jet power, principles and technical developments, a discussion of the uses of rocket and jet power, an estimate of the future, and a discussion of rocket power as a possible medium of interplanetary travel.

G. Edward Pendray has had years of experience both as a science writer and as a rocket experimenter. He was one of the organizers of the American Rocket Society and is a past president and currently secretary of the organization. He also edited *Astronautics*, the society's magazine. His book is not only more complete than the Zim book, but has been edited better to include the latest available information on German rocket developments of the present war. While some of this material has been included in the Zim book, the work as a whole has been incompletely edited to assimilate it.

Zim is more interested in the history of rocket-propelled missiles, and in interplanetary travel, whereas Pendray is concerned with the more recent experiments with rockets, including the research of Goddard and Oberth. Both books are indexed, and Pendray includes a lexicon of rocket terms. On the whole, his book can be regarded as the more authoritative and complete.

CURTIS FULLER

HIGH JOURNEY, by Carleton Putnam. Published by Charles Scribner's Sons, 597 Fifth Ave., New York, N. Y., in 1945. 308 pages. Price $2.75.

This book review originally was scheduled for the August issue. This reviewer, however, found himself absorbed with High Journey to such an extent that he spent a good deal of time wandering back to reread certain portions.

Not that this book will smash to the top of all best-seller lists. It won't, because it deals with an element that so few people can fathom deeply, even in this air age today. But what kept us going back through this book was Mr. Putnam's deep, rich feeling for the vast beauty and romance in aviation generally, and private flying in particular. Mr. Putnam proves himself deeply sensitive to the beauties of flying; he has magnificent feel for the seemingly insignificant things that make cross-country private flying the pleasure it is.

The book deals, too, with the trials of Chicago and Southern Airlines (Chicago-St. Louis-Memphis-New Orleans), of which Mr. Putnam is president. This part of his narrative also is interesting reading, but it is not as inspiring as the story of his early flights around the United States in an old Curtiss *Robin*. Mr. Putnam is perpetually fascinated and awe-struck by the wonders of aviation. He has done an excellent job of expressing the feelings that even the most insensitive of us have for this vast new element.

High Journey is well written. Its main fault is that it wanders away too much from the excellent Putnam word-paintings of the joys and satisfactions of flying, and strays into early American history of which the author obviously is an avid student. Despite this shortcoming, however, High Journey will be a source of much enjoyment to the imaginative soul who has shared with Mr. Putnam the experience of climbing away from the grimy earth, alone, and heading for the distant mountains.

MAX KARANT

AIRPOWER FOR PEACE, by Eugene E. Wilson. Published by McGraw-Hill Book Co., Inc., 300 West 42nd Street, New York, N. Y., in 1945. 184 pages. Price $2.

The entirely new concept of air power envisioned by the author is the sum of an equalized balance between air force, air commerce and the vast aircraft industry. A striking argument is convincingly presented against counter-claims that maintaining our dominant air power will strain our fiscal resources.

In his posts as vice chairman of United Aircraft Corp. and president of the Aircraft Industries Association of America, Inc., Wilson is uniquely situated to speak on this subject.

An article, "Three Keys to Air Power" by the author will be found on page 28 of this issue of FLYING.

LAWRENCE KEIL

FLYING
"Don't take that captain-goes-down-with-the-ship tradition too literally."

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AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the Carpenters Bldg., Washington 1, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time.

NEW CIVIL AIR REGULATIONS

In reply to numerous requests from AOPA members, below are the major changes in the Civil Air Regulations which became effective July 1, and those revisions applying to Air Traffic Rules effective August 1.

Copies of the new CAR, Part 20, Pilot Certificates; Part 43, General Operation Rules; and Part 60, Air Traffic Rules, are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for five cents each.

MEDICAL CERTIFICATES: Effective June 1, student and private pilots were permitted to take third-class medical certificate examinations from their own physicians. The form for this purpose (ACA 1345) is available from CAA inspectors and must be taken to the physician in order that he may perform his examination in accordance with the requirements. However, under the new regulations commercial pilots are still required to take their physical exams from CAA medical examiners.

Student and private pilot examinations have been somewhat relaxed and the examining physicians now refuse a certificate only when a disease exists which might suddenly incapacitate the pilot.

KNOWLEDGE REQUIREMENTS: Aeronautical knowledge requirements for a private license have been changed and the written examination includes only questions on General Operation Rules (Part 43), covering certification and maintenance of aircraft, equipment and instruments, general piloting rules, privileges and limitations of the various grades of pilot certificates, and Air Traffic Rules (Part 60). Meteorology and navigation questions have been eliminated. The minimum age at which one may obtain a private pilot's license has now been reduced from 18 to 17 years.

PRIVATE FLIGHT TEST: For a private license it now includes three figure-eights, with the plane moderately banked, and the angle of bank in the 720° power turn changed from 60° to 45°. Spirals are eliminated, as well as simulated forced landings. Several co-ordination exercises have been deleted but climbing and gliding turns at minimum controllable speeds are added. Recovery from right and left spins of at least one turn are required. On this maneuver, the student is now accompanied by an inspector or a flight examiner.

EXPERIENCE REQUIREMENTS: Under the new rules, 10 hours minimum of dual instruction in conventional planes and seven hours in non-spinnable aircraft are stipulated, of which at least two hours must be after solo. A total of 30 solo hours in conventional planes, and 20 hours of solo flight in non-spinnable aircraft now constitute the private license experience requirement.

In addition, one must have had at least three hours of solo cross-country flying, including one flight to a point not less than 50 miles distant from the point of departure, with at least two full-stop landings and take-offs at different points along the course.

NEW PRIVILEGES: Instruction may now be given by any pilot who holds a private license but only a commercial pilot may give instruction for hire. This permits a private pilot to give instruction to his family and friends (not for hire); however, the private or commercial pilot who does not hold a flight instructor's rating may not authorize a student to solo *nor do such lessons reduce the amount of instruction required by rated instructors.*

LOGBOOKS SIMPLIFIED: The new rules require that a record of the flight time used to substantiate recent experience requirements for certificates or ratings be kept in a logbook. The logging of other solo or dual flight time is no longer required.

HORSEPOWER RATINGS ELIMINATED: Horsepower ratings have been eliminated entirely and pilots are now rated only by class and type of aircraft they are competent to pilot, such as single-engined land (or sea) and multi-engined land (or sea). No pilot may carry passengers unless within the preceding 90 days he has made at least five take-offs and five landings in an aircraft of rated horsepower within 50 per cent of that of the aircraft to be flown. A pilot may, however, fly solo any aircraft of any horsepower within his class and type.

Private and commercial pilots have until July 1, 1947, to exchange their present certificates and ratings for those provided for in the new rules. This applies, of course, only to pilot certificates which have been effective on or after January 1, 1942.

AIR TRAFFIC RULES: Contact flight rules have been liberalized. The minimum altitude for flight is 1,000 feet over cities and 500 feet elsewhere, except where flight at lower altitudes will not, under normal conditions, endanger persons or property on the ground.

The minimum altitude for instrument flight is 1,000 feet. A pilot flying contact may fly at any level right up to the cloud base at any ceiling less than 700 feet. He must not, say the new regulations, fly above 700 feet until the ceiling is more than 1,200 feet.

There are no changes in the new rules with respect to approaching or overtaking aircraft or the rules of right-of-way in landing. The previous regulations governing these matters remain a part of the new rules. END

CHART OF VISIBILITY AND PROXIMITY-TO-CLOUD MINIMUMS

		Inside Airport Traffic Zone	Outside Airport Traffic Zone but Inside Control Area	Elsewhere
Flight at altitudes of more than 700 feet above earth's surface.	Visibility	3 miles	3 miles—1 mile with traffic clearance.	1 mile
	Proximity to Clouds	500 feet vertically. 2,000 feet horizontally.	500 feet vertically. 2,000 feet horizontally.	500 feet vertically. 2,000 feet horizontally.
Flight at altitudes of 700 feet or less above earth's surface.	Visibility	3 miles	1 mile	1 mile
	Proximity to Clouds	500 feet vertically. 2,000 feet horizontally.	In approach zone, 500 feet vertically; 2,000 feet horizontally. Outside approach zone, clear of clouds.	Clear of Clouds

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From 90° to 179° inclusive	Odd thousands plus 500 (1,500; 3,500)
From 180° to 269° inclusive	Even thousands (2,000; 4,000)
From 270° to 359° inclusive	Even thousands plus 500 (2,500; 4,500)

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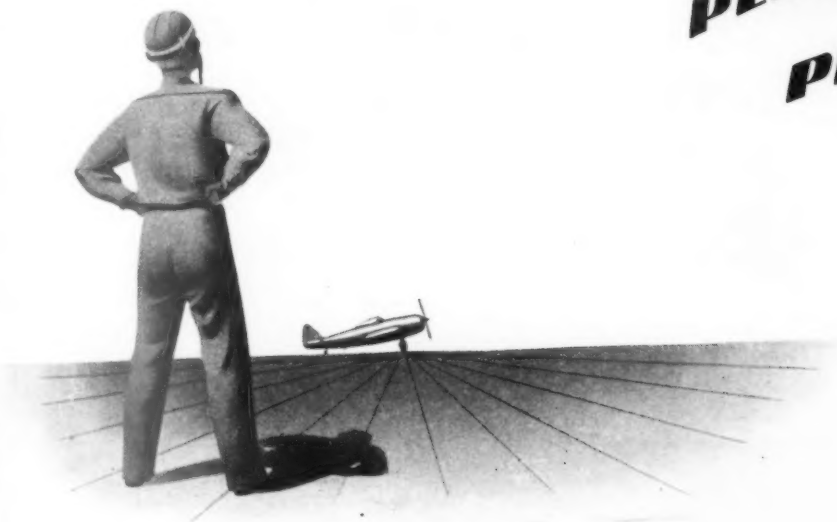

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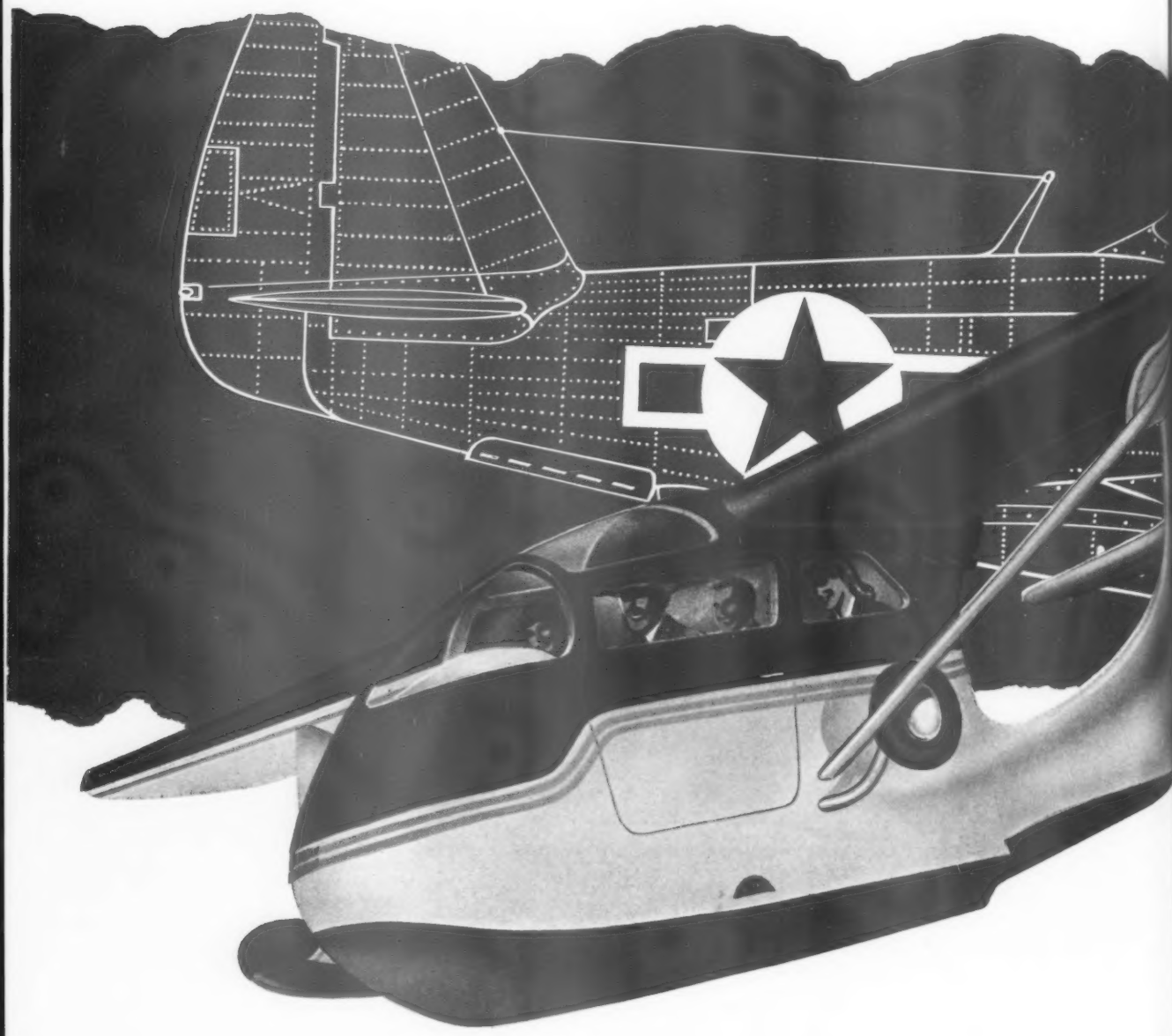

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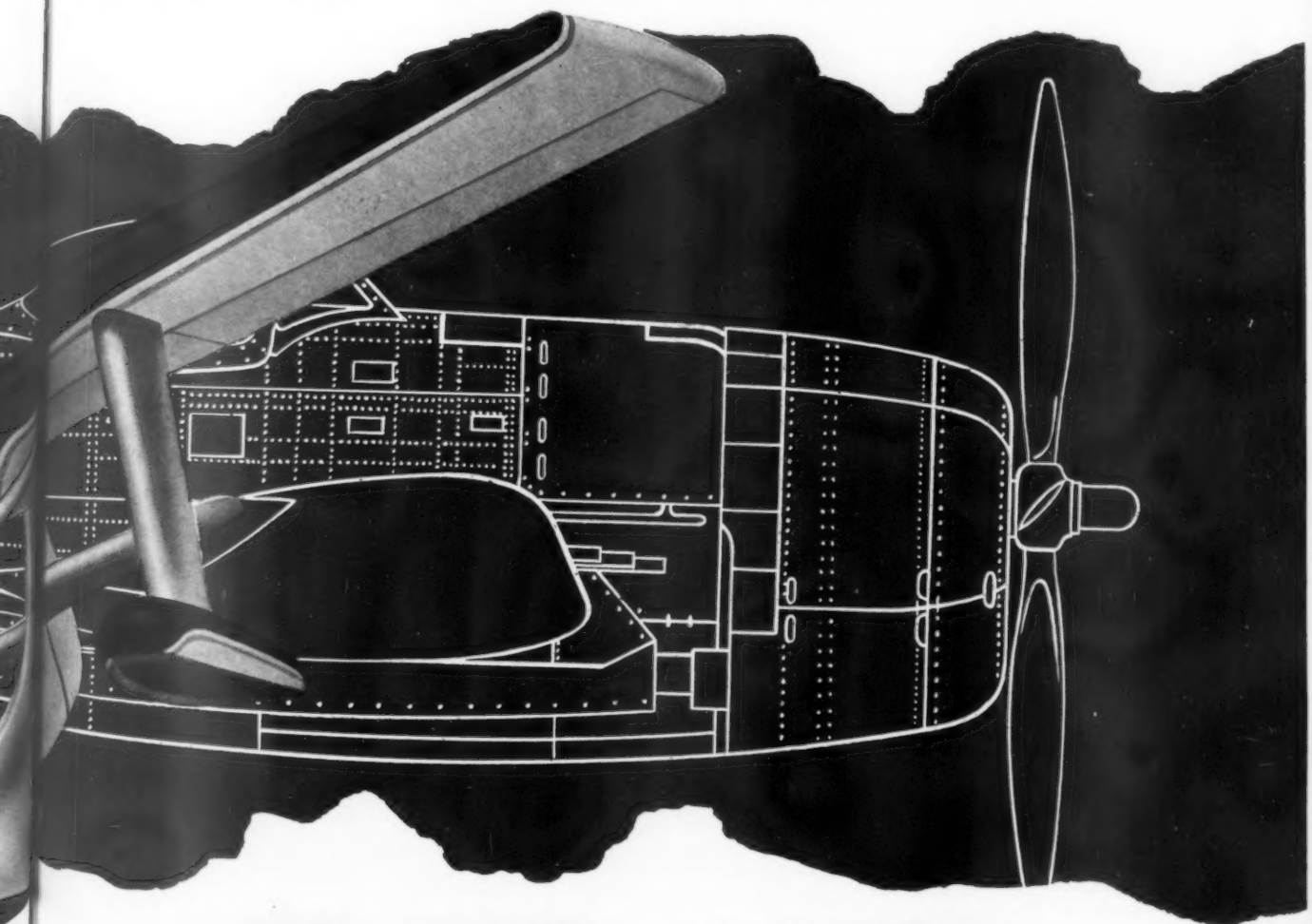

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Japan's Air Forces

(*Continued from page 32*)

5. Offensive action against our new bases on Iwo Jima and Okinawa.

DIVE BOMBING: Japanese dive bombing attacks, most frequent and effective in the early months of the war, are largely directed against shipping and beachhead operations. The accuracy of Japanese dive bombing is not outstanding and has been considerably affected by Allied antiaircraft fire and fighter interception.

The usual Japanese dive bombing formations are in multiples of three as follows: three-plane V's in line astern; in six-or-nine-plane V's; in V's of V's.

The bomb release point varies from 500 feet to as high as 3,000 feet. The release point, it is believed, is governed by the pull-out point of the lead plane and the intensity of antiaircraft fire. It also has been noted that the bomb-release point is generally higher during dives approaching the vertical where greater speeds have been attained.

When larger formations have been employed, Japanese dive bombers frequently divide their strength into smaller forces and attack a given target simultaneously from different directions.

GLIDE BOMBING: While occasional reports of dive bombing attacks at angles of 70° to 80° have been received, the majority of attacks have been made by a glide at an angle of 45° to 50°.

Bombers begin the dive at a height of 3,000 to 5,000 feet and follow each other down until near the target before releasing their bombs. Subsequently, the planes employ their machine guns, during the brief interval of pull-out, in high-speed strafing of ground installations.

TORPEDO BOMBING: Daylight torpedo bombing approaches are usually made in close formation at medium altitude. Glides are made at an angle of 40° to 45° and torpedoes are dropped from an altitude of 200 to 300 feet at a range of from 500 to 1,200 yards from the target.

Night torpedo attacks (including dawn and dusk) were greatly developed by Japanese in 1943 and followed a nearly uniform pattern. Reconnaissance planes drop variously colored flares to reveal the course of the convoy and to identify targets by types. Torpedo planes then attack singly, with the bulk of the force coming from one direction, while a few attempt to approach from another course. The attackers skim the surface of the water; drop their torpedoes at less than 1,000 yards.

FIGHTER TACTICS: Early in the war the Japanese fighter tactical unit was normally a squadron of nine planes, subdivided into three flights in either V or echelon formation. Fighter formations usually flew at altitudes of 15,000 to 20,000 feet but are believed to have operated effectively at altitudes of 27,000 feet or higher.

Recently the Japanese have shown a tendency toward adoption of the standard U. S. Air Forces basic fighter formations, consisting of two-plane sections and four-plane flights. Considerable co-ordination between planes and sections is evident, with sections fighting in pairs and alternating their positions in attack.

Deceptive tactics of various kinds have been extensively employed by Japanese fighters in efforts to lure Allied aircraft out of formations. Fake "dogfights" have been staged, and decoy tactics have been employed with one plane at low altitude protected by others flying at high cover and ready to pounce upon the unwary fighter who may take the bait.

Head-on attacks against Allied fighters were generally avoided until after increased armor was installed in Japanese fighters.

The degree of co-ordination achieved by Japanese fighters varies greatly. In many cases attacks are not co-ordinated—and at other times a high degree of co-ordination has been attained. Reports from the Southwest Pacific indicate a trend toward greater co-ordination and increased skill in frontal and waist attacks.

The Japanese rely to a great extent on the maneuverability of their planes. While their tendency toward acrobatics has steadily diminished as its ineffectiveness became apparent, the variety of the attacks employed has commensurately in-

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creased. Japanese fighters are particularly observant of any damage inflicted on Allied bombers and are quick to take possible advantage of it. Stragglers are a favorite target for concentrated attacks. When a tight formation is made by Allied bombers, attacks are usually concentrated on their leader. However, Japanese fighter pilots are not consistent in the degree in which their attacks are pressed home.

ATTACKS ON AIRFIELDS: During the early period of Japanese occupation and expansion, full advantage was taken of the weakness of Allied air and ground defenses. Japanese carrier-borne aircraft operated in conjunction with land-based medium bombers. Dive bombers attacked antiaircraft positions and ground installations, with fighters strafing grounded aircraft from low level.

Later, as ground and fighter defenses became more formidable, the Japanese were forced to conduct their bombing operations from higher altitudes. By 1943, their characteristic attack was by night, with single aircraft or small to medium formations of medium bombers. There have been occasions when the Japanese have reverted to daylight attacks, as in their attacks on aircraft based on forward strips in support of Allied ground forces in New Guinea.

AIR-TO-AIR BOMBING: The use of air-to-air bombs against Allied bomber planes was first reported in May, 1942, in the Southwest Pacific Area. Since that time there have been an increasing number of reports of the use of air-to-air bombs against Allied heavy-bombing formations. Air-to-air bombs dropped by the Japanese are reported to be timed explosives and incendiaries. They have been released both singly and in pattern arrangement.

Air-to-air bombing by the Japanese reached its peak of proficiency in the latter half of 1944 through the use of a new short-delayed fuse which makes possible a close approach before bomb release. The damage caused has been insignificant compared with the effort expended.

B-29's: Japanese fighter pilots have, to date, been baffled by the speed and firepower of our *Superfortresses*. Their air-to-air bombing has had some slight success. New Japanese fighters, *Jack* and *Frank*, have recently been operating against the B-29's.

SUICIDE ATTACKS by *Kamikaze* (literally "the Divine Wind Corps") since Leyte have been frequent and determined. Evidence indicates that an actual suicide attack organization has been formed and that members receive special training for work of this nature.

The Japanese claim that these groups were "voluntarily created" and that the first units appeared among the Navy flyers during the second Naval Battle of the Philippines. The units are made up of four or five flyers and more than 35 different units exist. Tokyo also boasts of other thousands of young men, 19 to 25, who are specially trained for this work. One broadcast said that the educational prerequisite for permission to die for the Emperor is two years of high school, to be followed by specialized training for a two-month period. The flyers wear a white scarf head dress as a symbol of their status, are strapped into their planes and wear no life-saving devices.

Japanese suicide tactics take full advantage of cloud cover. Some attacks come in a dive from 4,000 to 8,000 feet with the plane coming astern and attempting to hit the flight deck of the carrier, preferably one with planes on deck. There is another suicide method which calls for flying into the ship and aiming for the island of the carrier or pulling up, doing a wing-over and attempting to crash the ship somewhere in the island or bridge area.

The Japanese suicide plungers have attacked all types of ships, from battleships and carriers to tankers, transports, cargo vessels, destroyers, and motor torpedo boats.

The U. S. Navy reports that a *Jack* was shot down January 9, 1945, by antiaircraft and crashed without burning. The pilot, dead, was found dressed in a kimono gown known as a "Black Dragon Gown." The Navy infers from this that funeral services were conducted before the departure of the flyer on his suicide mission.

To date most suicide attacks have been attempted by Japanese Naval air forces. The planes most frequently used are *Zeke* 52's, *Val*, *Jill*, *Judy*, *Betty* and *Frances*. JAF planes in suicide attacks also include *Oscar*, *Tojo* and *Nick*.

BOMBING TACTICS: Japanese bombing tactics exemplified certain of their natural traits: courage, indifference to losses, and adherence to preconceived plans.

In 1941-1943 the Japanese usually preceded long-distance bombing missions by ample air reconnaissance. Before the main bombing force left its base, alternative objectives were designated. Airfields were given high target priority.

Evasive tactics against antiaircraft fire are taken by maintaining altitude above the effective range of such fire, by occasional changes in altitude, and by weaving in formation.

Bomber operations against important targets have been characterized by repeated attacks and "follow-up" missions. Many of the attacks appear to have been made along the same route and at the same time each day, although not necessarily by the same type of formation.

When the Japanese found themselves on the defensive, late in 1943, they virtually abandoned daylight horizontal conventional bombing attacks and adopted dawn and dusk bombing by fighters and night bombing by medium, torpedo and dive bombers. They attempted also to improve efficiency and co-ordination in

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THE latest production version of the *Mustang*, the P-51H is similar externally to its predecessor but has many improvements under its skin. Though 700 pounds lighter, it has been strengthened 10 per cent.

It incorporates a new section of the laminar flow wing series; drag has been reduced; the need for greater fuel-carrying capacity eliminated and speed has been boosted to well over 450 m.p.h.

Its new Packard-built Rolls-Royce V-1650 engine develops over 2,000 war emergency horsepower. A four-bladed Aeroproducts propeller replaces the Hamilton Standard prop. It is able to operate at over 42,000 feet compared with 40,000 feet.

Empty weight is 6,396 pounds. It carries 10 "Zero Rail" rockets under the wings; six .50-caliber machine guns, and racks to carry up to 1,000 pounds of bombs or extra fuel tanks.

Between the "D" and the "H," the "E" died on the design boards; the "F" weighed 1,200 pounds less than the "D" but proved too light, and the "G" was similar to the "F" but was powered with a Rolls-Royce—instead of a Packard-built engine. There never was an "I" model. The "J" was built around a 1,150-h.p. Allison. The "K," built in Dallas, Tex., was the same as the "D" but had an Aero prop.

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night torpedo and bombing attacks against shipping en route or at anchor.

Proof of the increased proficiency of the Japanese in night air combat tactics is indicated by the fact that they have raided AAF bases in China, Saipan, Morotai and the Philippines with some success. The net results may be classified as mere "nuisance," qualitatively, but some B-29's have been destroyed by Jap night attacks.

RECRUITMENT AND TRAINING: The average Japanese aviator is 26 years old, stands 5 ft. 2 in. in height, weighs 122 pounds and has had the equivalent of 10 years of schooling.

Since they were fully cognizant of the importance of aviation in modern warfare, the Japanese years ago instituted national programs to interest youth in flying. Elementary instruction in air mechanics was and is being given from primary school upward. After finishing their primary schooling at the age of 14, pupils of demonstrated ability are sent to youth air schools and from there to middle and higher schools and universities. In the intermediate educational level construction of model airplanes is taught. Some schools even have gliders for training purposes.

Prospective pilots for the Army Air Service are sent to special training schools where initial air training is given.

The monitoring service of the Federal Communications Commission reports on the basis of Japanese homefront broadcasts that the Japanese army has become increasingly interested in recruiting of special army pilot cadets. The month of June, 1944, was selected for a special drive to obtain young men in this branch of the service. Those who qualify must be under 28 years of age, must be in attendance or have attended schools as high or higher than technical institutions, and must pass two special examinations, one a preliminary and the other an aptitude test. After one year of training the cadets will be commissioned officers.

The Japanese radio, in a home service broadcast, said recently that boys between 14 and 19 years of age, with permission of parents or guardians, may now apply for admission to the Navy Class A Air Force training school as cadets. Applicants must take both physical and written examinations. The standard for the written sections corresponds to the first half of the third year of middle school.

The Japanese home radio has also announced that these trainees may aspire to promotion to the rank of admiral. Previously such candidates could hope only for the rank of "special captain." Theoretically the new regulation removes the distinction between trainees and aviation graduates of the Imperial Naval Academy.

TACTICAL ORGANIZATION: Japan does not have an independent air service. The Japanese Army Air Service is an integral part of the army, while the Japanese Naval Air Service is organized independently as an integral part of the navy. The Japanese emperor, through Imperial Headquarters, controls both air forces.

Ranking Japanese air officer is the inspector general of aviation (Rikugun Koku Sokambu), who is directly responsible to the emperor for matters pertaining to air training, while in other respects he is subordinate to the "Big Three" (chief of general staff, minister of war and inspector general of military training).

The Japanese Army Air Force is organized into five known air armies, each having clearly defined areas and functioning as administrative headquarters for its tactical units. Co-ordination between air and ground forces is obtained by placing the air army under the command of the theater commander who is thereby enabled to control operationally both air and ground forces.

There is no accurate parallel (numerically or planewise) which can be made between the U. S. and the Japanese air army. Functionally the following equivalents can be made:

Japanese Title (Romanized Form)	Translation	Closest U. S. Equivalent by Function
Hentai	Air Section	Flight
Hiko Chutai	Air Company	Squadron
Hiko Sentai	Air Regiment	Group
Hikodan	Air Brigade	Wing or division
Hiko Shidan	Air Division	Numbered air force
Kokugun	Air Army	Theater or allied airforce (strategic and tactical)

The construction of a Japanese air army or lesser segment will vary in accordance with the type of plane and function. Generally, however, the following formula is accurate:

Air Section	3 aircraft
Air Company	3 sections
Air Regiment	3 or more companies
Air Brigade	3 or more air regiments
Air Division	2 or more brigades
Air Army	2 or more divisions

The Japanese Naval Air Service was organized originally as a highly effective striking weapon, with light maneuverable aircraft of high performance characteristics that were well adapted to support swift thrusts by amphibious forces. The function of the air forces in these operations was to provide cover for the task forces involved and, by swift surprise attacks, to destroy the opposing enemy air force on the ground or in the air, thereby clearing the way for landing operations. The Naval Air Service was equipped to operate either from carriers or from land bases and frequently has undertaken the permanent defenses of land bases.

ARMAMENT: The Japanese show very little originality in their aircraft armament, except in modifying foreign designs, such as those of Great Britain, United States, Switzerland, and Germany. The only weapon that might be called truly Japanese is the Model 89, Nambu type, magazine-fed, aircraft machine gun which was converted from the Nambu ground machine gun. Even this, however, is a modified Hotchkiss design. It appears that a great number of noninterchangeable types of ammunition exists for aircraft guns of the same caliber. The Japanese employ aircraft guns with calibers ranging all the way from 7.7 mm. to 37 mm.

OXYGEN APPARATUS: Designs of Japanese oxygen systems and their parts are good, although the basic principles used are not considered the best. There is an automatic regulator of good design. The flow of oxygen is shut off until 10,000 feet is reached, at which altitude an aneroid lifts the metering needle, allowing oxygen to pass through the outlet.

NAVIGATION EQUIPMENT: The Japanese seem to have good navigation equipment. The few navigational instruments that have been captured in good condition have been of simple but effective design, indicating much copying from other countries. One automatic pilot was found to be so similar to a type manufactured in the United States that parts in some instances were interchangeable without modification.

Japanese instruments on the whole are more or less copies of instruments used in this country several years ago. Mass production methods were used on some

15 YEARS AGO

FROM the September, 1930, issue of this magazine:

The Curtiss XBT-4 was selected as a new military advanced trainer. Latest innovation was a mirror mounted in the upper wing so the instructor could observe his student.

Jimmy Haizlip, assistant to James H. Doolittle, won the Free-for-all trophy race at Springfield, Mass., in a Travel Air *Mystery Ship*.

A new ground flight training device, called the Link Aviation Trainer, offered "rides" at 25 cents each. The unit, pneumatically operated, scored the pilot's efficiency on an automatic dial indicator.

Warner Aircraft received a type certificate permitting manufacture of its new 90-h.p. five-cylinder engine.

The Boeing "100" biplane with a top speed of 196 m.p.h. at 8,000 feet was acclaimed the world's fastest fighter. Engine was a 425-h.p. *Wasp*.

The Russell *Comet*, a 100-m.p.h. high-wing monoplane, was priced at $1,750. The 400-pound plane had a 35-h.p. engine giving a rate of climb of 700 f.p.m.

Of 12,000 licensed pilots in the U.S., nearly 200 were women. Licensed mechanics, numbering 8,500, included four women. Licensed aircraft totalled 6,600.

Aeronca announced a new seaplane at $1,995. The twin-float plane weighed 470 pounds, had top speed of 80 m.p.h., cruised at 60. Take-off run required seven seconds.

First airmail snatch pickup from a motor boat was accomplished at Detroit. A cable stretched across two poles on the boat was hooked by a low-flying mail plane on the first attempt.

Igor Sikorsky celebrated the 20th anniversary of his first flight in a plane of his own design, a model S-2 with a 25-h.p. Anzani engine. Top speed: 50 m.p.h.

Consolidated's new 33-passenger, flying boat, *Miami*, had just been launched at Buffalo, N. Y. It was to be used by the NYRBA line on South American flights. The *Miami* was a development of the 24-passenger *Commodore* flying boat.

Snap-on Tools

"... long preferred for their ready adaptability to the many types of equipment we operate"

Says

Fleets of giant stratosphere clippers cruising global routes at 300-mile speed ... Pan American World Airways waits only the all-clear to transform yesterday's "fantastic dreams" into dramatic accomplishment. And as in Pan American's earliest pioneering flights, Snap-on tools will play a vital part in these operations. "Snap-on tools have been long preferred for their ready adaptability to the many types of equipment we operate", says Pan American. "So too will this be true in our future global operations where flights will range from 100 to 2400 miles — 2400 miles non-stop."

Used in maintenance operations by every major airline ... preferred wherever planes are built, operated or maintained ... Snap-on tools have won undisputed leadership as *the tools of aviation.* Write for 1945 catalog of 3,000 Snap-on tools for production, assembly and maintenance.

SNAP-ON TOOLS CORPORATION
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of them, while on others much hand-finishing was in evidence.

NIGHT-FLYING EQUIPMENT: Specimens on the aircraft examined to date show very little improvement over equipment used in the United States Air Force several years ago. No individually-lighted instruments, except the pilot's compass, have been found.

PARACHUTES: The Japanese use a quickly attachable seat-type parachute for their bombers and transport crews. Another seat-type parachute is used by pilots of fighters and other smaller aircraft.

PHOTOGRAPHIC EQUIPMENT: To date very little is known about the advance designs of Japanese photographic equipment. All of it in a good enough condition to test has been copied from equipment manufactured in the United States several years ago.

FLOTATION GEAR: Specimens have been found in some planes. This equipment consists of a rubberized cloth bag which is held in place by eight pieces of woven cotton reinforcing tape attached to each corner. The gear is inflated by a carbon dioxide cylinder which is located behind the pilot's seat.

FUEL TANK PROTECTION: A type, referred to as "self-sealing," is 1⅛ inches thick. It is made up of six rubber layers reinforced by an inner silken mesh and an outer galvanized iron mesh. The self-sealing properties of this type appear to be good, at least on the outer surface. A jettisonable fuel tank made of wood has been examined, is of plywood panel 7/64 inches thick.

FUELS AND LUBRICANTS: From the samples of fuels and lubricants that have been obtained, it has been found that the Japanese fuels are good, although some contain a rather high amount of aromatics.

BOMBSIGHTS: Examination of a damaged bombsight revealed that it operated on the same principle as the French bombsights manufactured at the beginning of the present war.

JAPANESE BOMBS: In general they are made of steel and usually are not streamlined. Except for the armor-piercing and semi-armor-piercing bombs, they are of three-piece construction, consisting of nose, body, and tail.

Some of the more common type bombs are the anti-personnel bombs ranging from 2.2 to 33 pounds; incendiaries from 2.2 to 550 pounds; and high explosives from 110 to 1,760 pounds. For night tactics there is a 72.6-pound illuminating flare.

TORPEDOES: The Japanese make use of five types of torpedoes which differ in weight, length, diameter, speed, and explosive charge. Most standard models measure 17 feet long with a diameter of 17.7 inches. These torpedoes weigh 1,800 pounds and have an approximate speed of 42 knots.

RESCUE EQUIPMENT: A limited amount of Japanese sea rescue equipment has been made available for examination. A 5-mm. pneumatic, rubber life raft, measuring 12 feet long by 3 ft. 10 in. wide, was below current U. S. standards. As to rescue equipment for one man, a kapok life belt was found to be identical with the Navy kapok jacket. A horseshoe-shaped pneumatically-inflated life preserver also is used.

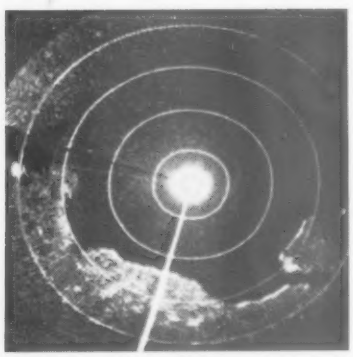
CLOTHING: The Japanese air forces receive a good grade of clothing. The flying suits, made of silk and cotton, are well-tailored and similar in design to flying suits used by the United States Army Air Forces. The Japanese also have an efficient, electrically-heated flying suit which, when worn as an outer garment, compares favorably with United States electric suits.

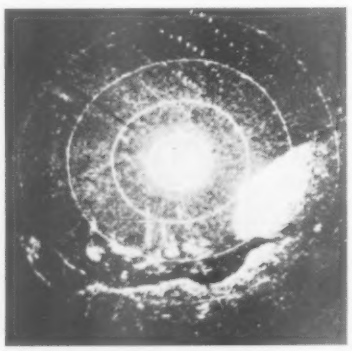
RADIO: Japanese airborne transmitters and receivers, sturdily and compactly constructed, are of excellent workmanship and material. Japanese equipment uses a large amount of aluminum, so that even bulky pieces are unusually light in weight. Although no precautions have been taken against corrosion and fungus control, reports indicate that equipment later than 1940 is far superior to that of earlier design. Electrically and mechanically, new radio equipment appears to approach Allied standards.

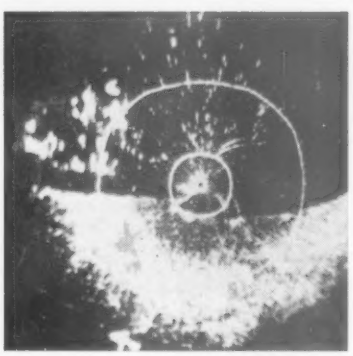
Not all Japanese planes have radio equipment. While radio direction finders are standard equipment on medium and heavy bombers, there have been no reports indicating that they are normally fitted to fighters. Radio equipment that was made in America, either in whole or in part, has been found on several Japanese *Zekes*. Most parts are of Japanese manufacture but components of German and English manufacture have been reported. There is no evidence of quantity production; indeed all equipment noted is hand-made and of good construction.

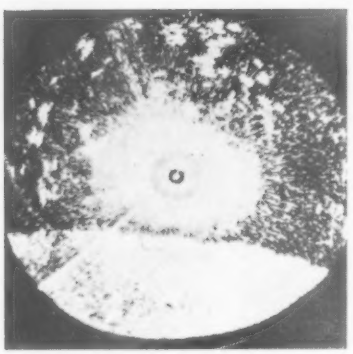
ARMY AIR HISTORY: Aviation came to Japan when the Army began experimenting with airplanes in 1911. This laid the foundation for the air arm under the guidance of French military aviation instructors in 1919. In that year, an aviation section was created in the war ministry. The civil aviation bureau *(koku kyoku)* was established in 1920 under the supervision of the war ministry. The largest expansion of civil air service began in 1938.

The first military aviation school was opened at Tokorazawa in 1920 and two years later schools were established at Shimoshizu and Akenogahara. By 1935 there were eight *hiko rentai* (air regi-









RADAR IN ACTION

HERE is the Normandy invasion beach as viewed through solid clouds in the radar scope of an 8th Air Force bomber on D-Day. The haloed light within the center circle (upper left) is an Allied reconnaissance plane. A large area of the coastline is clearly defined.

White grains and blobs (upper right) are part of invasion fleet offshore. The plane passed over the fleet and crossed coastline (lower left). Then the radar operator flicked a magnifying switch, to obtain an enlarged picture of a small section of coastline (lower right). His radar helped him to plot a course and advise the release point of bombs, since overcast kept pilot and bombardier from observing action below.

Tired of snow, slush, chilling winds? Well, even if you can spare only a week end, you're within easy reach of White Sulphur, Gulfport, or Palm Springs... maybe all three... *when you Cessna.*

Whatever warm, sunny "fountain of youth" calls you when wintery winds blow, there's your very best answer... a precision-built, safety-engineered, postwar Cessna of your own.

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Nineteen reasons why... for your postwar personal airplane, you too will *choose Cessna.* They are the nineteen important units —wing leading edges, rudders, elevators, fins, dorsal fins and other vital parts—that Cessna is making for the Boeing Superfortress.

This work has given Cessna the two things indispensable in building the airplane of all-metal structure that you will want for your postwar Family Car of the Air—modern, precision, production facilities plus priceless manufacturing and engineering experience.

After the war, we'll need time for reconverting our plant... and then you'll be able to select your Family Car of the Air... to meet all your travel needs and your pocketbook... from the complete line of new Cessnas, *all Cessna-Engineered for Safety,* economy and performance.

Cessna

THREE TIMES JUDGED "THE WORLD'S MOST EFFICIENT AIRPLANE"

ments), believed to have been controlled by the ground headquarters of the army.

In 1936, a form of administrative and operational headquarters, called *koku keidan* (air groups), was created to provide the first separate operational control of flying units. This type of headquarters was expanded in 1938 into *hikoshudan* (air groups). The *hikodan* (air brigades) were created in 1940, presumably as intermediate headquarters between the *hikoshudan* and the *hikosentai* (air regiments).

In the spring of 1942, the administrative and operational setup for controlling flying and other field units of the air arm was greatly expanded. The *hikoshudan* (air groups) were converted into *hikoshidan* (air divisions) in April, 1942, and *kokugun* (air armies) were established on June 1, 1942, to control the several *hikoshidan*.

Throughout these reorganizations, the successive operational headquarters were under divided supervision, taking operations orders from the chief, Army General Staff, and administrative orders from the War Minister. Training instructions came from the army's inspector general of military training until the *koku sokambu* (inspectorate general of aviation) was established in December, 1938, to control aviation training.

Supreme command of the Japanese armed forces, both army and navy, is lodged in the *Daihonei* (Imperial General Headquarters), a wartime organization superimposed on the peacetime organizational structure. The headquarters comprises the chiefs of the army and navy general staffs, the ministers of war and navy and other designated officers. END

Clothes Make the Superman

(*Continued from page 50*)

seated pilot is to increase the weight on his buttocks and push him down in his seat.

A pilot who weighs 150 pounds at one G consequently weighs 300 pounds when the centrifugal force reaches two G and 600 pounds at four G. Ordinarily, four or five G is about all a man can take without blacking out, according to various studies made on human centrifuges.

Of primary importance as a symptom-producing factor is the duration of the G force. At least three to four seconds are required to produce symptoms for forces up to 10 G. Furthermore, the symptoms from any given force will develop fully during six to 10 seconds of exposure to the force.

Relaxed subjects, sitting upright in a conventional cockpit seat, perceive dimming of vision during 10 seconds at three to four G; tubular vision, or loss of peripheral vision, at three and one-half to five G; complete blackout, or blindness, at four to five and one-half G, and true unconsciousness between four and one-half and six G. Of tactical importance is the realization that in stages of dim, tubular, and blacked-out vision the pilot's orientation to time and place is preserved and a return to normal vision occurs in three to five seconds after the force abates. Conversely, return to consciousness, once lost, does not occur for 15 seconds to one minute and is accompanied by disorientation as to time, place, and person. In short, blackout and unconsciousness are strikingly different.

Another factor which influences the effects of G on man is the rate at which G force is applied. If the onset is gradual (up to one and one-half or two G per second) the full play of symptoms is perceived by the pilot: dimming, tubular vision, and blackout occur in orderly sequence before unconsciousness supervenes. At higher rates of onset, such as occur in snap pullouts (three to 10 G per second), unconsciousness may occur without a warning play of visual disturbances.

A similar precipitate passage from clear vision to unconsciousness occurs at times in subjects who are very tense and frightened, when the subject on the centrifuge may withstand successively at five-minute intervals four, five, and six G for 10 seconds each, only to become unconscious on the fourth run at seven G without having experienced greying or blackout.

Present evidence suggests that the blood pressure which exists before G exposure influences markedly the G resistance displayed by the pilot, an observation which correlates well with those items known from experience to raise the G tolerance. It is an old procedure for the pilot to tense his muscles, yell, or growl when he pulls the stick back.

The older explanation of failure of the cranial circulation was that the proximate cause was a diminution of cardiac output which was due, in turn, to a failure of cardiac filling. It was thought that the dilation of the veins below the heart was caused by the multiplication of the hydrostatic pressure as the blood grew heavier under G.

Principal objections to this theory are that the process of venous pooling is probably too slow to account for blacking out in three to five seconds and that continuing studies of the heart under G fail to support the early conclusion that the heart grows empty under G.

The emphasis has shifted to a consideration of alterations on the arterial side of circulation. In the standing man, being acted on by one G, there normally exists a difference in hydrostatic pressure between arteries of the brain and arteries of the leg. Yet there is adequate circulation both in the head and in the toes, because the status of the arterioles in the lower extremities is more constricted than those in the head. A certain quantity of blood passes out of the arterial tree per unit time, but enough is retained to maintain the diastolic pressure.

When G force precipitately increases from one to five, the hydrostatic pressure in the lower arteries markedly increases without reduction in the size of the arterioles through which the blood runs off. As a result, more blood runs away from the arterial system per unit time than when the arterial pressure is normal. Pressure in the heart is lowered at the same time that more pressure is needed to maintain flow through the upper blood vessels because the blood is now five times heavier. Thus, at one G a pressure of 25 mm. of mercury is required to support the column from the aortic valve to the brain, and at five G a pressure of 125 mm. of mercury is required.

Continuance of moderate G force beyond 10 seconds results in improvement of symptoms, not increase of them. With the reduction in arterial pressure in the neck as a result of G, the depressor stimuli normal to the carotid sinus decrease markedly. After about a 10-second latent period, peripheral constriction occurs and the circulation has an opportunity to re-establish itself. It is safe to assume that if the pressor reflex could react quickly enough, blackout would never occur below the G level of five.

Blackout was encountered by the aces of World War I but for the most part they were able to keep up with their frail aircraft. In addition to both voluntary and involuntary tension mechanisms, pilots eventually learned that crouching helped, inasmuch as it reduces the vertical distance from heart to brain. One drawback to crouching is that, because of other important requirements, American cockpits are made deep and the gunsights placed high. While bending over, the pilot cannot look out or sight his guns. Through experience, fighter pilots learned not to exceed their individual blackout threshold. This put them far behind their airplanes in performance, since modern aircraft engineering has provided airplanes strong enough to take much more G than can the individual who flies them.

Just who was the first to develop anti-

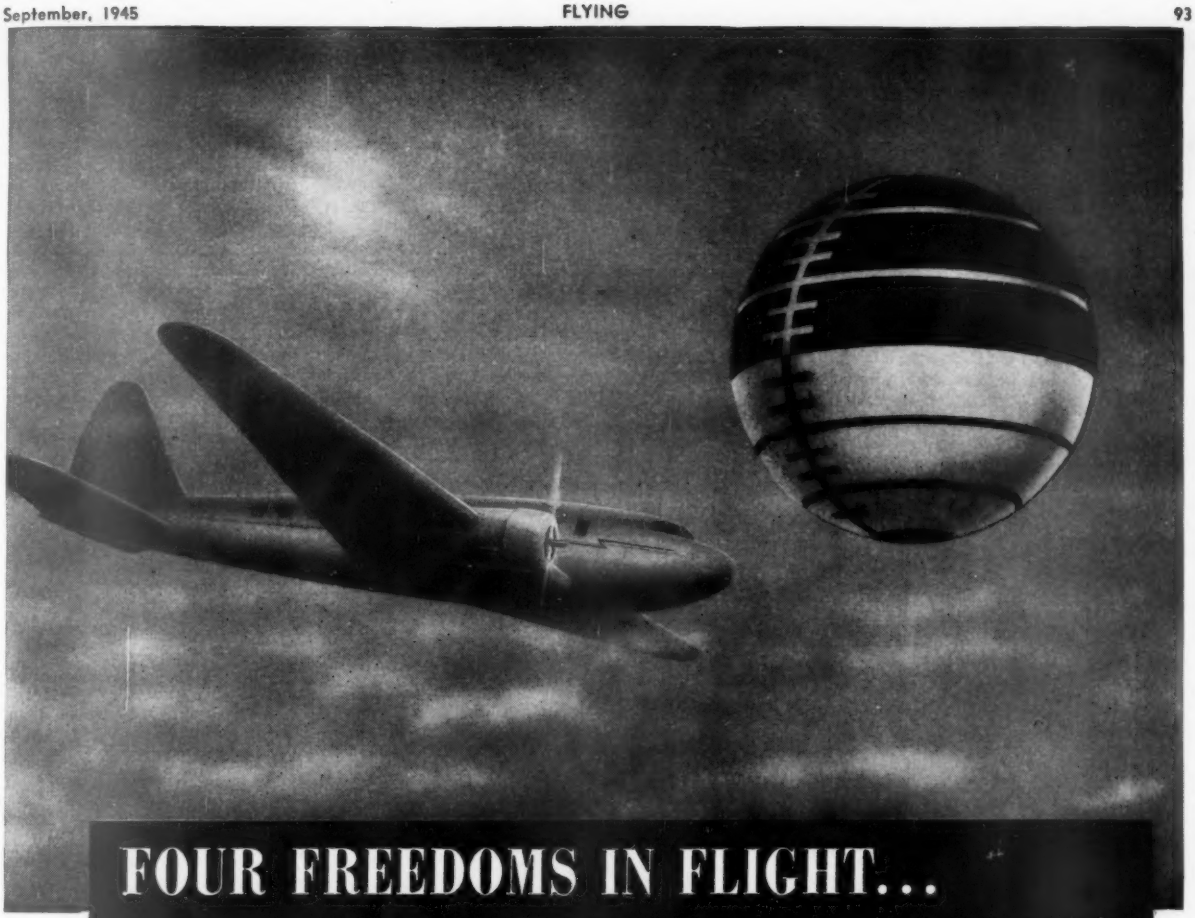
SURVIVAL STORY

FORCED to ditch his *Privateer* in the teeth of a North Atlantic hurricane, Lieut. James O. Trudeau and five other survivors of his 10-man crew rode out the storm on a Mk. VII (seven-man) raft and made a landing on the coast of Ireland. During their 36-hour battle with icy wind and waves, the survivors lost an average of 15 pounds apiece—one died of exposure almost within sight of land.

So runs one of the many survival stories of members of the American division of the Goldfish Club—an organization comprised of pilots and aircrewmen who ditched their planes at sea and saved their lives through use of emergency life jackets and dinghies.

To apply for such membership, the following information should be submitted to the American Secretary, Max Karant, Managing Editor, FLYING, 185 North Wabash, Chicago 1, Illinois:

1. Name, rank and serial number
2. Service address
3. Home address
4. Date and location of incident
5. Description of incident
6. Signature of applicant
7. Signature of commanding officer



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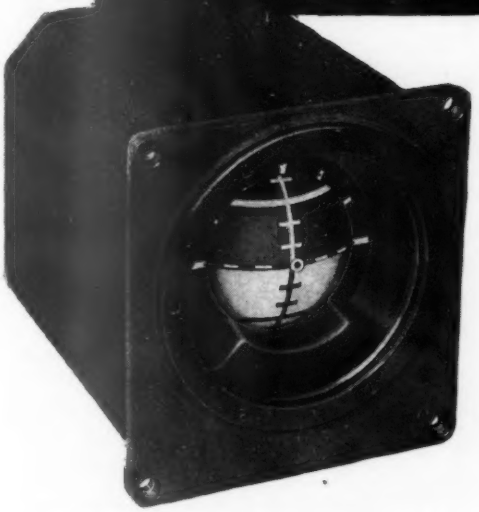

Now, for the first time, the pilot knows the attitude of his plane continuously, at any flight angle, regardless of visibility or extreme turbulence.

An electrically driven gyro stabilizes a sphere which is universally mounted—without limit stops—allowing full 360 degrees freedom of indication about the roll and pitch axes of the airplane. (The airplane actually maneuvers around the indicating sphere.) No caging is needed!

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blackout wearing apparel is not clearly established. The idea of girdling the abdomen with a tight belt to restrict the downward movement of the blood is as old as World War I. In the years leading up to World War II, quite a number of air-minded physiologists wrestled with multiples of G.

Following experiments on dogs at Harvard in 1932, Capt. John R. Poppen, Navy medical officer, designed and flight-tested a tubular belt which was placed around the abdomen and inflated by a hand bulb. The Germans and British worked on similar devices. None was entirely successful. Col. Harry G. Armstrong and Dr. John W. Heim, aero medical pioneers in the Army Air Corps, tested such a belt on a 20-foot centrifuge that they built of spare parts at Wright Field in 1936, and found it of some benefit.

German scientists built a human centrifuge in 1934. Using the centrifuge they developed a "water suit," which encased the body with a walled-in layer of water from neck to feet. Centrifugal force acted on the water in the casing the same as it did on the blood in the body, building up a compensating pressure gradient. Thus, the pooling of blood in vessels of the lower half of the body was restricted and cerebral circulation was maintained. Due to the great weight and bulk, this "flying bathtub" idea was discarded.

The Germans later turned to designing airplane cockpits so that the centrifugal pull on the pilot would tend to be across his body instead of head to foot. They raised the rudder bars and tilted his seat back, enabling him to crouch readily when turning or looping. They even experimented with flying the pilot in a prone position. The idea of laying the body parallel to the line of flight was sound inasmuch as the body can tolerate excessive centrifugal force acting transversely to its long axis, or from front to back. But there were practical drawbacks.

Wing Comdr. William R. Franks of the Royal Canadian Air Force took up the problem of acceleration in 1939 at the University of Toronto. He designed a rubber suit which could be pressurized with air or water. Water became the choice in an 18-pound, waist-high modification which effectively prevented blackout in 1940 flight tests by the RCAF. The "Franks Flying Suit" was further tested on the giant centrifuge built at the University of Toronto in 1941 and the British Fleet Air Arm used it in the battle of Oran in November, 1942. The water suit has had only restricted operational use but it has served to stimulate the interest of many others in attacking the problem.

While Franks was developing his "five-quart" suit, Dr. Frank S. Cotton of the University of Sydney built another human centrifuge. In co-operation with the Royal Australian Air Force he made a 25-pound anti-G suit operated by carbon dioxide gas. The suit applied a gradient of 16 different pressures to the body from ankles to abdomen.

In 1939 the Navy flight-tested another version of the Poppen belt which was later featured in the movie "Dive Bomber." The next year, Berger Brothers Company of New Haven, Conn., makers of corsets and surgical supports, became interested in "foundation garments" for flyers. Frederick Moller and Roy Versoi of Bergers produced a simple, single-pressure, pneumatic belt and stockings in co-operation with the Navy, the National Research Council, and others. These were designed to be inflated by hand. Later an automatic valve operating off the airplane's vacuum instrument pump was substituted. The pump supplies air pressure while creating the suction which keep the rotors of the turn and bank indicators running. The pressure can also be used to operate de-icer boots and prevent air locks in jettisonable gasoline tanks.

The Navy-Berger experiments were now on the right track but, as frequently is the case in scientific research, there were a few blind alleys. The result was a 20-pound, seven-pressure, massage suit, so-called because its various air pressures pulsated. From that, the Navy and Bergers turned to a 10-pound, three-pressure suit—a pair of tight, high-waisted pants with built-in suspenders and girdle containing 17 air bladders. Termed the G-1, or gradient pressure suit, it was first tested by the Navy in Pacific combat in September, 1943, and given extensive trials in the strike at Palau the following March. Pilots declared the suit a great success but too hot and cumbersome.

Meanwhile Dr. E. J. Baldes and Adrien Porter had built a human centrifuge at Mayo Clinic in Rochester, Minn. There, Dr. Earl Wood, Dr. Charles Code, and the David Clark Company (underwear makers of Worcester, Mass.) developed an arterial occlusion suit. This worked on the principle of a tourniquet, placing strong encircling pressure on each thigh and arm so that the blood circulation was stopped in the limbs while the pilot was exposed to blackout. Tests showed that this suit provided more anti-G protection

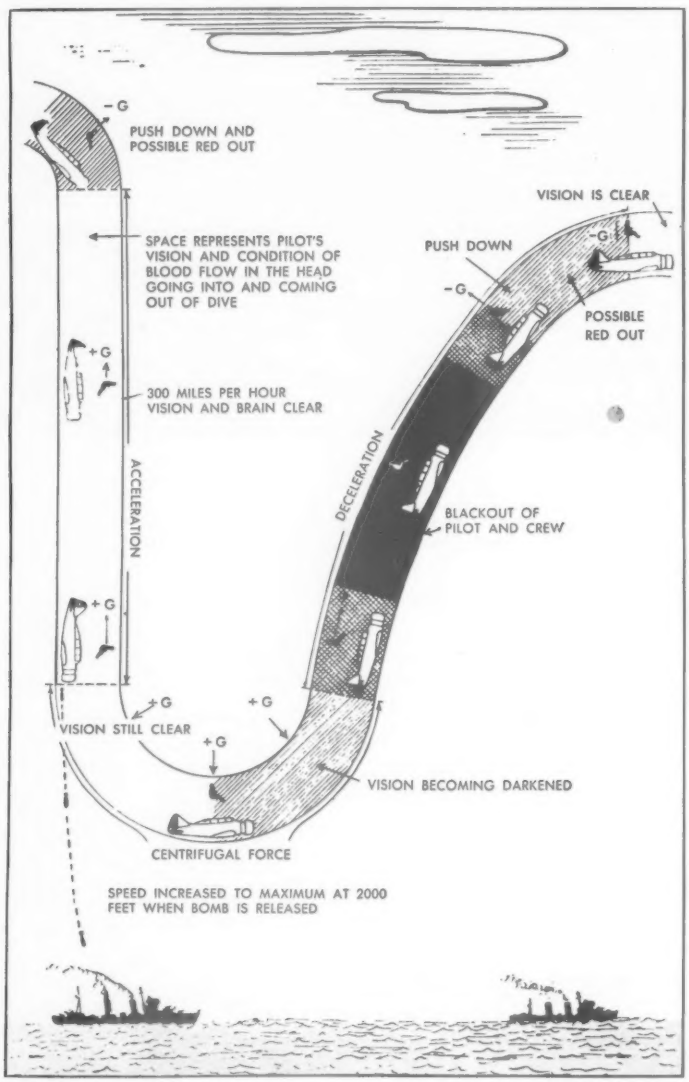
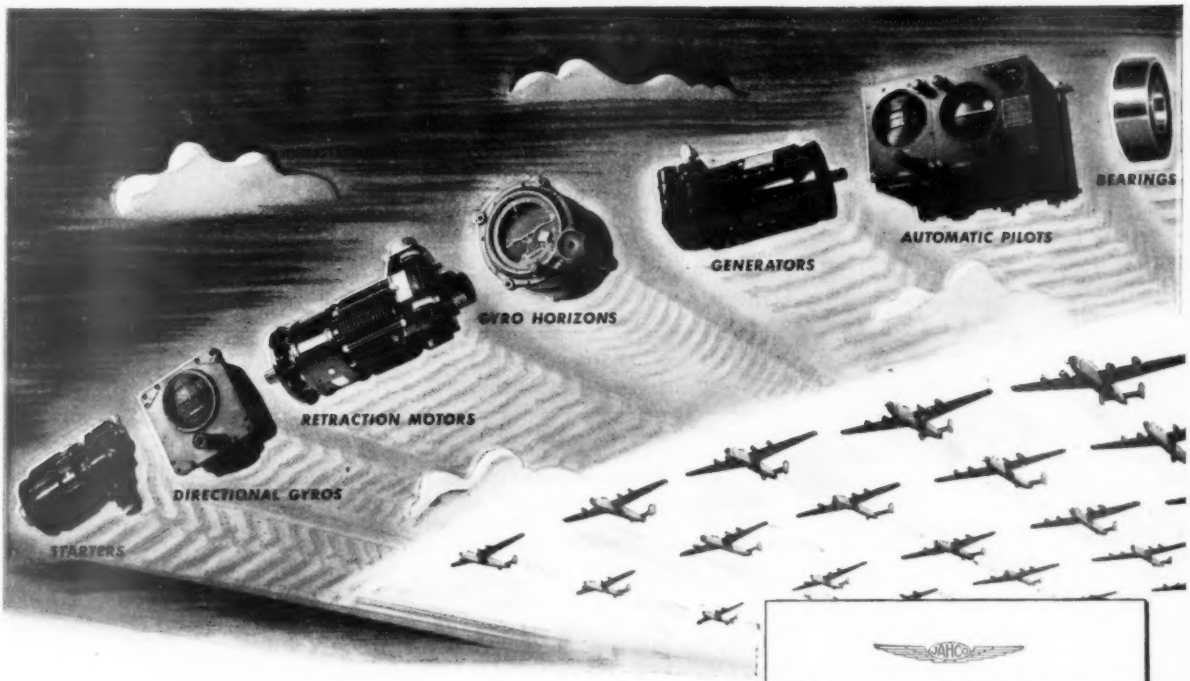


Diagram represents blackout sequence of pilot and crew during dive bombing attack.

"These are a few we can talk about now"



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than the gradient pressure suit—in fact, more than was desired, but is was not acceptable because of the length of time it would cut off circulation in prolonged maneuvers.

Such, roughly, was the state of acceleration research when the Aero Medical Laboratory got its modern human centrifuge in operation at Wright Field early in 1943: there were many people with many anti-G devices but few fighter pilots would wear them. The centrifuge, a turntable with a 48-foot double boom, was designed to spin the cabs at either end from 0 to 90 m.p.h. in nine seconds—with a maximum centrifugal force 22 times gravity. Capt. George L. Maison, Chief of the Acceleration Unit, was the first to ride it. Since that time, 280 persons have made several thousand runs on the machine, which is equipped with appropriate safety and recording devices. Made under the supervision of Lieut. Col. F. Gregory Hall, chief of the physiology branch, all these tests and numerous flight tests by the AAF Proving Ground Command at Eglin Field, Fla., were calculated to find the most suitable anti-G suit for the Army Air Forces.

The G-1 was the choice—but with reservations. The Aero Medical Laboratory determined that the suit's three pressures should be reduced to one because there was "precious little difference in the three pressures." With the co-operation of Berger Brothers and Mayo Clinic, this was done. The result was the G-2 suit, which resembled the G-1 in style, but contained five bladders instead of the 17, and weighed six and one-half pounds instead of 10.

By January, 1945, the Army Air Forces had distributed several thousand G-suits, with the G-3 having superseded all other models. The G-3 is a two-pound, cutaway-pants version of the G-2. It was suggested as an answer to the complaints of both Army and Navy pilots that earlier models were too bulky and hot. The G-3 contains five bladders which place pressure upon the abdomen, thighs, and calves when the centrifugal force exceeds two G. Interestingly enough, the G-3 completed a circle of development by returning to the principle of simplicity advanced in Berger's first pneumatic belt and stockings. The G-3 is usually worn over ordinary GI pants. Also available is a 2½-pound G-4, a coverall type originated by the Navy and made by the Clark company. Flat-top pilots prefer it since it takes the place of a flying suit.

While the G-suit increases the individual's ability to withstand G on the centrifuge only by one to one and one-half G, pilots report that they have pulled up to eight or nine G in tests without so much as a gray-out. None has reported a blackout while wearing the suit. The apparent reason for the increased resistance in flight as contrasted to centrifuge runs with the G-suit is natural tension during aerial maneuvers. In deliberate tests, it has been possible for a G-suit fancier to wrinkle the skin on the wings of a *Mustang* without blacking out.

The G-suit had great success in the European theater. Its popularity among fighter pilots at any time and in any group has been an index to amount of enemy opposition encountered in the air. The comments of the fighter pilots read like paid testimonials: "I have nicked six Jerries since I got my G-suit." "I racked my ship in a 180° turn to destroy a plane and dodge flak at the same time. Without the suit, I'd have blacked out." "I'm damned if I'd fly without it." The G-suit has made certain maneuvers, which were previously considered foolish or fatal, a matter of course.

The tactical advantage applies not only to plane-to-plane dogfighting but to fast maneuvers in tight formation and to sustained deflection firing while circling. Evasive action during low-level strafing and dive-bombing, particularly to avoid flak, can be carried out much more rapidly with the G-suit. In all these maneuvers the pilot can sit up and look around to the side and rear without fear of blackout. The ability to keep his eye on the enemy is the fighter pilot's best life insurance and some men actually owe their lives to the G-suit. END

The Lightplane Dilemma

(*Continued from page 66*)

over 80 per cent of the applicants." The specific reasons mentioned by the students were:

Pleasure of flying	52.0%
Pleasure transportation	18.6%
Flying as an accomplishment	10.3%
Total non-business	80.9%

Indeed, during the years immediately ahead, the sporting appeal of flying promises to rank equal to, if not actually far above, the utility appeal. The manufacturers and sales organizations that recognize the relative importance of psychological considerations may be far more realistic and successful than those that, basing their appeal solely on utility and practical transportation, stress comparative time saving, comfort, safety, and economy in competition with the automobile, railroad, and airliner.

Whereas most discussions of the uses for lightplanes tend to concentrate upon the private owner, little attention has been given the operators who use aircraft in commercial services and who up to the present have constituted a market of major significance. Even though the proportion of noncommercial personal flying is generally expected to expand rapidly, the fixed-base operator who uses the airplane as a sales demonstrator, for flying instruction, rental purposes, sightseeing rides, and the other miscellaneous purposes will probably continue to be an important customer. Actually, in the past even a substantial proportion of those aircraft listed as privately owned were originally purchased by dealer-operators as demonstrators and then later sold to individuals as used airplanes; many other planes sold directly to individuals have been purchased at a substantial discount under an arrangement whereby the dealer-operator retained privileges of use for demonstration and training purposes.

For every individual who can afford to own his own airplane there are dozens who want to fly and will be able to do so only in rented planes. Flying clubs are a partial answer to this situation. The fixed-base operator who provides flight instruction and rental airplanes, however, probably will continue to be a major user of light airplanes for a number of years, as well as an important sales outlet.

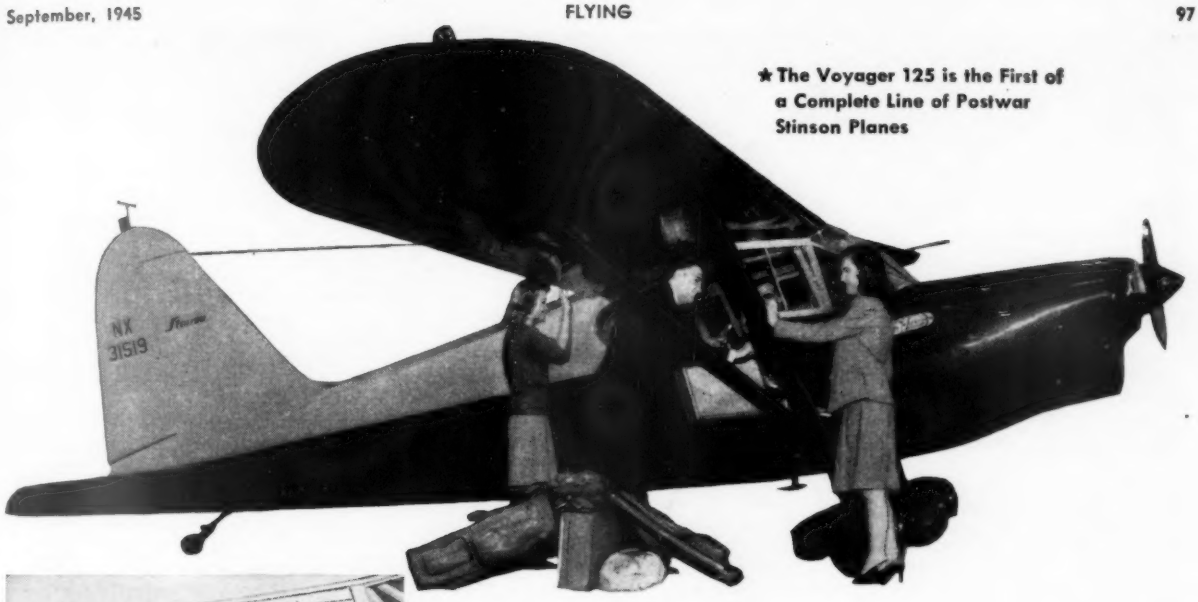
At the outset, certain basic assumptions appear justified regarding the way in which private airplanes will be most effectively sold for at least a number of years following the war:

1. *Specialized organizations will continue to prove most satisfactory.* Numerous schemes for selling airplanes through or in co-operation with established dealers for other products have been tried unsuccessfully. For obvious reasons the automobile dealer with his capital, customer relations, and sales "know-how" has intrigued aircraft producers and distributors. The buying appeals and sales methods, however, to date have not proved sufficiently similar to make the established automobile dealer a generally effective aircraft sales outlet. The airplane buyer has customarily proved far more technically minded than the automobile buyer. The aircraft salesman therefore has needed to be a comparatively well-informed expert in aviation. Furthermore, successful selling of airplanes appears to be greatly facilitated by that communicable enthusiasm for airplanes found among the flying fraternity. The average automobile salesman can scarcely be expected to have this specialized knowledge and point of view. If the capital, management ability, and merchandising skill of successful distributors in other fields were to be applied to aircraft sales, at the least specialized personnel would appear to be required. Other factors suggest the desirability of entirely separate sales organizations.

2. *Sales will continue to be made most effectively through organizations based at airports.* Demonstration flights are an essential part of the selling job. Even the experienced flyer usually insists on flying a new plane enough to obtain a "feel" of its flight characteristics under varying operational conditions. This is seldom accomplished in just one demonstration flight. Some flight instruction in that particular plane is often required before the novice is willing to commit himself to a purchase. Flight instruction after purchase is also frequently a useful sales incentive. The prospective buyer naturally likes to be able to visit the airport at his own convenience, thus affording a substantial sales advantage to the dealer whose representative is always on hand. Furthermore, the dealer who is permanently based can assure prompt service on the customer's plane.

3. *Most dealers of necessity will also*

★ **The Voyager 125 is the First of a Complete Line of Postwar Stinson Planes**



First—FOR TOMORROW'S PERSONAL FLYING!

Four sit in comfort in the luxuriously upholstered seats of the ventilated and soundproofed cabin. There's full visibility in all directions for pilot and passengers.

You don't have to "stoop" and "crawl" to get in and out of the Voyager 125. Take a look, too, at the unusually wide doors and scientifically streamlined and positioned step.

Fully adjustable seats bring all controls within easy reach. Instruments are all grouped on the panel for quick reading and there is provision, too, for blind-flight instruments. There are wing slots to prevent spins and stalls, giving the plane unusual stability and control.

WHEN YOU take to the air in your Stinson Voyager 125, you'll really *load up* and *leave!*

This new personal plane by Stinson is a cross-country ship that will take four people. And there's plenty of room for luggage besides.

Take a look at these close-ups of the Voyager 125 and see what comfort, safety, and economy are in store for you when you fly your new Stinson.

And that day isn't too far off. For, although we're still busy building planes for our fighting forces, the Stinson Voyager 125 will soon be coming off the production lines in quantity.

In the meantime, we'd like to send you a booklet giving full information about the Voyager 125.

For FREE illustrated brochure, write Private Sales Director, Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Mich.

PERFORMANCE OF THE VOYAGER 125

Maximum speed	**128 mph**
Cruising speed	**116 mph**
Maximum endurance	**5 hours**
Maximum range	**580 miles**
Rate of climb	**670 fpm**
Service ceiling	**13,800 ft.**
Take-off at sea level	**550 ft.**
Landing run	**280 ft.**

Operating costs are low! You'll fly the Voyager 125 for less than 6 cents a mile . . . approximately 1¼ cents per seat per mile.

That includes everything . . . depreciation, complete insurance coverage, hangar storage, gas, oil, and reserve for overhaul.

Stinson

The Aircraft Standard of the World

FREE SERVICE MANUAL: A new and complete Service Manual for owners of the Stinson Model 10-A (Voyager 90) is now ready. Send NC and serial numbers of your Voyager 90 for your free copy . . . to Stinson, Wayne, Mich.

engage in activities other than the direct selling of airplanes. With the possible exception of a few areas in which the sales potential is unusually high, the local dealer will find other activities necessary in order to carry the overhead of adequate facilities and organization. Skilled flying instructors will be required both to give the novice lessons and to insure that the experienced purchaser understands the plane's flying characteristics. With instructors and training planes available, the selling of flight instruction on a commercial basis is then a logical step and further helps in the cultivation of a home market. A local dealer-owned repair shop also affords an invaluable competitive advantage in assuring the buyer prompt and expert service. Again, the solicitation of outside repair work is only logical in order that the overhead of adequate shop equipment and personnel can be carried. By a series of similar logical steps, the dealer finds himself in the business of storage, aircraft rentals, charter service—in short, carrying on most of the functions of conventional fixed-base operations. The advantage of having sales and other fixed-base operations conducted together is increased by the fact that the planes needed to carry on these essential commercial operations constitute a vitally important part of the market.

4. *The dealer's nonsales activities will often tend to interfere with sales efforts.* In more than one instance, organizations originally set up to sell airplanes have become so preoccupied with the multifarious other fixed-base operations that the sales effort became secondary. This tendency results from the fact that the revenue from other operations is more stable, usually is larger, and requires less sales effort than does the sale of planes. Furthermore, these other revenues are more easily developed without resort to personal solicitation off the airport. The apparently small potential sales volume immediately available to many of these dealers has further discouraged the establishment of a separate sales department or even the hiring of specialized salesmen.

Neglect of aggressive sales promotion is especially likely to develop and is of most serious consequence in the type of one-man-management organization characteristic of local dealer-operators. The causes of such diversionary developments will continue to be powerful after the war, thus necessitating careful planning and good dealer control by the manufacturer. The manufacturer may have to determine how and when specialized sales personnel can be justified. He may also have to assume some responsibility for training and otherwise aiding these salesmen. This is one of the factors favoring a factory representative's taking over the intermediary functions usually exercised by independent distributors, especially under those arrangements whereby the distributor is himself involved in fixed-base operations.

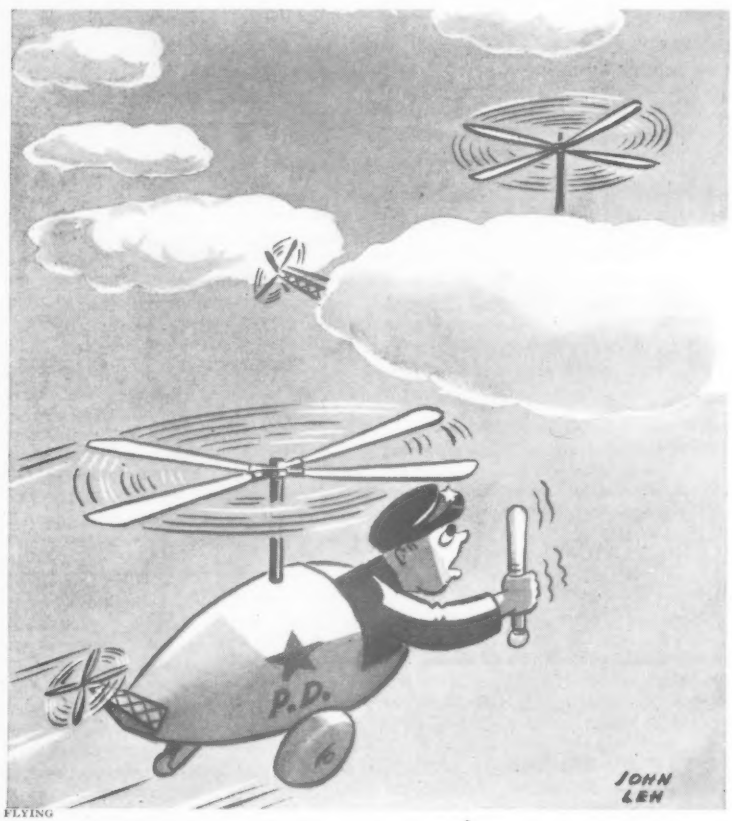
5. *The effective marketing area for most dealers will be confined to a limited local radius.* The great bulk of the plane-buying population will be located in an area with a radius averaging perhaps 25 miles from a local airport. Because of the importance of ground transportation time, most individuals interested in flying will tend to frequent a convenient local airport. Their knowledge and opinion of various airplanes will be strongly determined by the firsthand impressions developed at this local airport. Intangible product qualities are of such importance to the buyer, especially with regard to safety and maintenance characteristics, that comparatively few are likely to seek out a model that is not strongly and ably represented at their home port. Reliable service and local dealer responsibility are also important considerations influencing this buyer selection.

For these reasons, the efforts of a dealer at one base to sell airplanes in a distant operator's backyard are likely, as in the past, to prove barren. Individual dealer organizations may, of course, be able to compete effectively over larger areas by having a chain of bases. Where such coverage is possible, it will also tend to eliminate the difficult question of determining when the insertion of independent area distributors between the factory and final sales outlet is justified.

6. *In many of these "natural" territories, the sales potential will be inadequate to support the high-grade sales personnel needed.* A large proportion of the prospective airplane customers live in moderate-size cities and in smaller towns; furthermore, the per capita demand there appears to exceed that of the major metropolitan centers. In these areas, especially, the more sophisticated prospective dealers already show strong signs of recognizing that the limited territory in which they can sell with lowest sales costs and can compete most effectively from a single base—that is, a territory with a radius often not exceeding 25 miles—offers inadequate total sales potential to support the kind of local sales organization that both they and the manufacturer know they need.

7. *The stronger dealers tend to demand, and may often be able to obtain, territories far larger than they can effectively service.* These dealers will make such demands for two reasons. First, many of them recognize the inadequacy of the sales potential, at least at the outset, in the areas naturally served by their base. Secondly, the number of competing manufacturers promises to be much larger than the number of good dealer organizations in each area, and these dealers naturally tend to take advantage of their bargaining position. For the same reasons as in the past, however, a dealer's attempts to sell beyond the area of effective service for his base probably will prove unprofitable.

The distribution dilemma faced by the manufacturer thus is found to arise in large part from the fact that the natural marketing area for each sales outlet may, in many important localities, fail to offer adequate sales potential to support the high-caliber sales talent needed. The inevitable tendency to expand dealer areas threatens to defeat its own purpose by



FLYING

DIRECT HITS on the huge aircraft plant at Omura near Nagasaki are scored by the first wave of B-29's. More to come. *Official Photo U.S.A.A.F.*

So sorry!

The hell we are! The little yellow men up Tokyo way just can't seem to take a hint. Germany learned — the hard way. German top-ranking General Von Rundstedt freely admitted that Allied bombing had smashed Hitler's power to fight back.

But in Europe all we used were the "little" Fortresses and Liberators which could only carry three or four tons of bombs. The Superforts, however, tote up to ten tons. *And fast!*

The Japs are getting a tiny sample right now of the destruction these planes can deal out. If they were smart they would haul out the white flag now before they find themselves on the receiving end of 2000-at-a-clip bomber attacks.

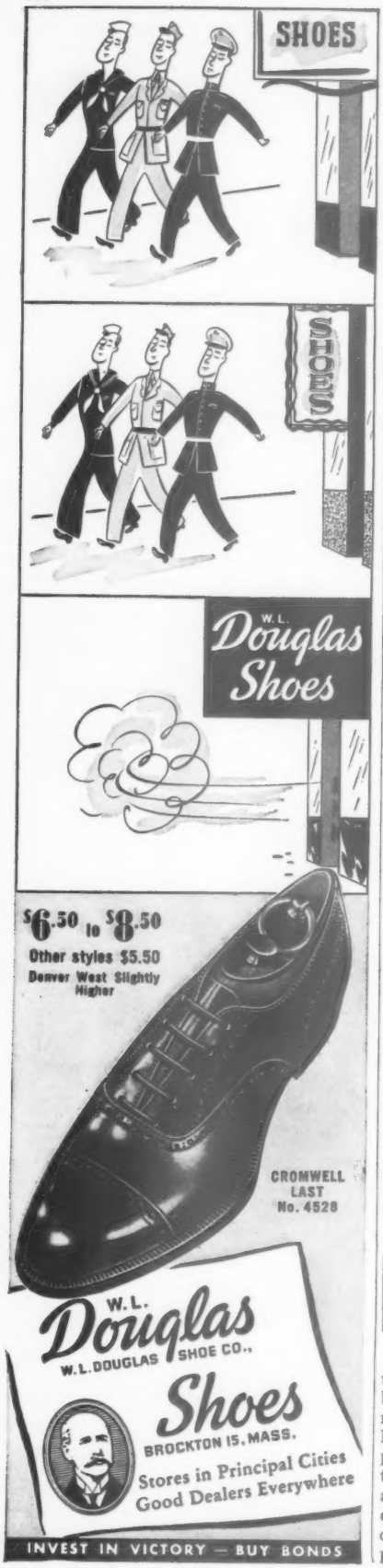
But if they don't . . . they'll just have to take it. And dishing it out will be vast fleets of these powerhouse Boeing B-29's, for whose great Wright engines we at Chandler-Evans are proud to be turning out precision-built carburetors. And sticking to this job is the best way we know to help ram Hirohito's face down his throat.

CECO

CARBURETORS
FUEL PUMPS
PROTEK-PLUGS

ARMY NAVY

CHANDLER-EVANS CORPORATION SOUTH MERIDEN CONNECTICUT, U.S.A.



simply resulting either in excessively costly or else totally inadequate sales efforts throughout much of the territory. The problem is greatly aggravated by the fact that the 20 or so manufacturers who may be offering good competitive products will need a sales outlet at most major community flying centers. At the same time, because most airplane dealers may find it necessary for competitive effectiveness to carry on a full line of fixed-base activities, only a small number will be able to justify their existence in each community. Because the bargaining position of the comparatively few good dealer organizations in each area will be strong, each may often succeed, as in the past, in obtaining territories 10 times the size they can service effectively. The net result of this natural tendency therefore may be that most manufacturers will find themselves with dealer coverage only 1/10 effective. On such a basis, these manufacturers scarcely can hope to attain soon a profitable sales volume.

In the private plane field, the manufacturer who tends to concentrate all his attention and advance work on engineering aspects probably will find that his marketing organization will almost inevitably develop along the lines of the "natural tendency"—which means that he will be one of the large number of entrants who fail to obtain reasonably adequate dealer coverage. Then, regardless of how fine his design and fabrication may be, the chances of his attaining a profitable volume of sales will be small.

Paradoxically, the companies which appear to have the greatest inherent technical advantages in entering the private plane field also appear most vulnerable to failure in merchandising—namely, the major wartime airframe manufacturers. Most of these companies previously have sold their product almost exclusively to the armed services or to air transport companies. Thus they have dealt with a limited number of technically minded buyers capable of appraising the fine points of operational differences. Management effort properly has been concentrated on competitive design development and, during the war, on problems of production capacity. When thinking in these companies turns to the private plane field it understandably focuses largely upon the question of competitive design. Progressiveness on this score, of course, is fundamental and absolutely essential. However, the need for progressive advance planning in selling to a public market in volume and the overwhelming importance of merchandising considerations may be discovered by some of these companies the costly way.

On the other hand, it is significant to note that those aircraft companies and executives who are more experienced in the problems of selling private aircraft tend to place a major emphasis upon post-war distribution plans. Should the helicopter, the roadable airplane, or any other pending development suddenly mature and thus greatly expand the aviation market, those companies which now emphasize the attainment of a superior sales organization would expect to have an invaluable asset with which to retain leadership.

Several companies which are carefully laying the groundwork for aggressive entrance into the post-war personal plane market already have assigned responsibility for distribution plans to the highest-grade talent available. Experience has proved that in solving distribution problems no ideal scheme or panacea can take the place of assigning the responsibilities to able men. Thus, the major factor determining which few among the many companies with good designs will succeed in attaining a profitable sales volume may well be found in the measure of caliber and competence of the men to whom the merchandising responsibility is assigned—provided, of course, they are able to start their work soon enough to get ahead.

As a possible solution to the distribution dilemma confronting the personal aircraft industry, one additional suggestion appears to warrant consideration. To solve his own sales problem, the manufacturer must solve the dealer's problem. The easy—and probably highly unsatisfactory—answer to inadequate aircraft sales potentials in many dealers' "natural" marketing areas is to extend their territories greatly. The other, and perhaps more profitable, answer is for the manufacturer to aid his dealers in a more intensive exploitation of the effective sales area. If, as appears probable, the immediate sales potential for airplanes is limited, perhaps an answer might be found in the development of a substantial sales volume in other products which appeal to the dealer's regular clientele and to the air-minded individuals who frequent his airport. With the increasing popularity of aviation, the merchandising possibilities at airports for products other than airplanes should not be overlooked in post-war planning. END

Bombing Balance Sheet

(*Continued from page 22*)

The proportions of incendiary bombs to high-explosive by weight were judged by studying the target. The predominantly fire-raising attack on Dessau, listed above, resulted in the almost complete destruction of the whole area attacked. But more usually incendiaries are in the proportion of about 25 per cent of the total load where a great deal of breaking up is necessary, to about 70 per cent when the target proves to be of a highly inflammable nature.

Typical examples of incendiary proportions as used by the U. S. Army Air Forces during 1944 are:

March 6	27 per cent incendiary
March 8	70 per cent incendiary
March 22	64 per cent incendiary

So much for the general picture of the whole of the Anglo-American bombing offensive against German and German-

U. S. Navy's Latest Jolt for Japs—The Grumman Tigercat

Out of a dozen years of experience in building carrier based fighters, and the applied lessons of current combat, has come the Navy's newest fighting airplane—the Grumman Tigercat. In the skilled hands of Marine pilots the new F-7-F will write new pages in the log of carrier warfare.

Grumman

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Over 700 miles per hour!

CURTISS WIND TUNNEL SPEEDS DESIGN PROGRESS

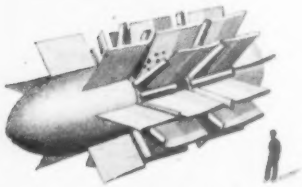
1 Into the 8½ x 12 foot test chamber goes a 10 foot span model. Sealed off from the balance of the tunnel, models may be changed or worked on in the chamber without affecting the test pressure of the tunnel itself.

THE aerodynamicist deals in the shape of things to fly. His workshop is a wind tunnel. His aim, to determine the behavior of full-size aircraft under all conditions before they are ever built or flown.

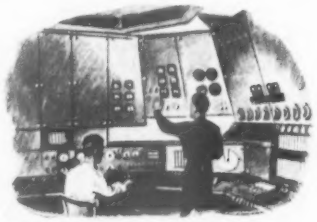
For him Curtiss-Wright constructed within its Buffalo Research Laboratory the largest, costliest variable density wind tunnel ever owned by a single aircraft corporation.

By compression or evacuation the air in the tunnel may be varied from 4 to 60 pounds per square inch to enable tests formerly requiring three or four tunnels.

Here, with no risk in human life and with tremendous savings in the time and money involved in building and test flying full-size aeroplanes, Curtiss-Wright speeds the development of aviation that all the world may more quickly and fully share its benefits and bounties.



2 Twin 16 blade, 22 foot diameter fans driven by a 14,000 horsepower motor capable of whipping 210,000 cubic feet of air through the tunnel test chamber at speeds approaching the velocity of sound.



All wind tunnel operations are controlled from this Console. The reactions of the model under test such as Lift, Drag, Pitch, Roll, Yaw, Crosswind and Load Pressure are recorded on dials automatically fed into special IBM tabulating machines. Within 20 minutes these mechanical marvels compute and deliver a mathematical picture of test results that would otherwise consume weeks of laborious human calculations.

3 Giant vanes at the corners of the wind tunnel direct the air around the turns, prevent it from "piling up" at the sides. Here, also, coolers take the heat from the air built up by the tremendous friction of many times tornado speed.

CURTISS AIRPLANES
DIVISION OF CURTISS WRIGHT
FIRST IN FLIGHT

occupied territory. We turn now to consider the bombs used, the special targets against which they were directed and the sighting and bombing methods which were developed during the European war.

Two main theories have been advanced regarding heavy bombing almost since bombing began. Both theories had adherents in 1939. The first was that precision bombing is possible; the second held that under active service conditions precision bombing is not possible and that all bombing attacks must therefore be considered statistically if they are to be properly evaluated.

At the beginning of the war the statistical theory was perhaps the more popular. A natural consequence was the view that the 250-pound bomb was the largest useful size for general purposes. It was better, according to this view, to cover a target area with a pattern of many small bombs than to try to obtain a direct hit with a few large ones.

Gyro-stabilized bombsights had been under development since 1917. But, although remarkably high accuracy was achieved with them in practice, accuracy decreased sharply under combat conditions. The vigor with which the heavy bombers were challenged by the German defensive fighters caused precision bombing to lose popularity.

The Bomber Command, which concentrated mainly on night work, introduced the so-called "tactical" bombsight, a simpler affair than the precision sights. They also cast about for simplified methods of bombing. Their efforts in the end led to the pathfinder technique.

The Pathfinder Force, with special navigational aids, was sent out to mark the target with colored pyrotechnics and it was upon these that the main bomber force concentrated.

The method was still mainly statistical. Even when the first ultra-large bombs came into use it remained so. The first of these ultra-large bombs were of the blast variety.

They were large canisters, not unlike the outside of the boiler of a railway locomotive, and they had a thin case. Their purpose was to initiate powerful shock waves in the air. Weighing up to 4,000 pounds they were found to be effective against many different kinds of buildings. The German cities testify to their power. Aachen, Julich, Düren, Cologne and other Rhineland cities were singled out by General Eisenhower as examples of massive damage. Krupp's now presents an area of two miles by one mile completely devastated. The 42 collieries, 10 synthetic oil plants and 22 marshalling yards of the Ruhr were neutralized mainly by blast and incendiary bombing attacks.

But the limitations of the big blast bomb were obvious from the beginning. Against underground factories they were all but useless. They could not dent the great concrete U-boat pens on the French Atlantic coast. They were incapable of destroying a viaduct, of destroying dams or deep oil storage tanks. They were ineffective against small specialized targets.

It was on May 16-17, 1943, that the public first became aware that some highly specialized work had been going on with the object of improving the striking power of big weight-carrying aircraft. This was the date of the attacks by Bomber Command *Lancasters* on the Möhne and Eder dams.

It is still not permissible to describe the instrument used for blowing these huge concrete structures because it is likely to be required again in the war against Japan. But it can be stated that it was the first outward sign that a highly original mind had been working on the super-fortification problem—and arriving at some very satisfactory solutions.

B. N. Wallis devised both dam-busting equipment and the ultra-large, armor-piercing bombs—12,000- and 22,000-pounders. They are high-velocity bombs that reach the speed of sound when dropped from about 15,000 feet.

Of high cross-sectional density, with ogival head, the big armor-piercing bombs are used with a bombsight developed at Farnborough. It was a further step forward in precision sighting from the Mark XIV bombsight with which most RAF squadrons were equipped and which was developed largely by Prof. P.M.S. Blackett and Dr. Braddick.

The first use of the 22,000-pound bomb was on March 14, 1945, when it was launched against the viaduct at Bielefeld. It brought six spans down. The Altenbeken viaduct and the Arnsburg viaduct were also brought down with the 12,000- and 22,000-pound bombs.

Examination of the Arnsburg viaduct shows that two spans collapsed into the river Ruhr, though it is not certain

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FEATHER POWER...DEPENDABLE SAFETY
IN YOUR NEW
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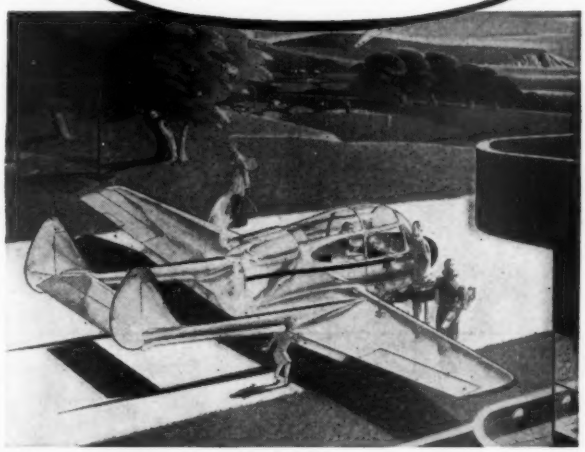

THE SAFE, SMART, PRACTICAL AIRPLANE THE EXPERIENCED PILOT AND THE EAGER NOVICE HOPE TO OWN!

Designed by one of America's foremost aeronautical engineers, the new Skycraft will possess many features of speed, power, safety, utility and economy never before built into the personal plane. From the tip of its sleek nose to its slender twin booms, you will find that the new, pusher-type Skycraft will produce an ease of flying and of landing... of extra speed and maneuverability... of comfort and security for one or the whole family, on business or on pleasure... it's the safe, smart, practical future airplane the experienced pilot and the eager novice have hoped someday to own. Right now—the construction of vital warcraft parts comes first... so, plan your order now, for Tomorrow!

WARCRAFT PARTS UNTIL...

The Skylark Manufacturing Company is engaged in the precision-manufacture of motor mounts, flame dampers, truss assemblies and other parts vital to combat planes of the allied nations. Perhaps Tomorrow—conditions will permit *all-out* production of the Skycraft.

DESIGNED AND MANUFACTURED BY
SKYLARK
MANUFACTURING COMPANY, INC., VENICE, CAL.
AIRPLANE & PARTS CRAFTSMEN SINCE 1934

whether the cause was a direct hit or the undermining effect of the large bombs on the viaduct's foundations.

The coming of these new bombs and new bombsights soon altered the aspect of statistical and precision bombing. Precision bombing gained significance. A new weapon had been created for big weight-carrying aircraft. And the aircraft itself had not undergone much change for it had been found that the ordinary *Lancaster* (with a few minor modifications, chiefly the removal of some defensive armament) could take the 22,000-pound bomb.

Bombing attacks now took on a new accuracy. U-boat shelters being built at Farge, near Vegesack, on the Weser, were attacked with the 22,000-pound bomb on the afternoon of March 27, 1945. They were broken up and the oil storage depot nearby was also badly damaged.

The railway bridge across the Weser, near Bremen, was brought down. When we entered the city, the E- and R-boat shelters at Rotterdam, which had been attacked in December, 1944, were found to be badly damaged. In one place roofing had collapsed in an area of 120 by 38 feet.

These attacks called for a comparatively small force and were more militarily economical than the vast blast bomb attacks of the earlier period of the war. They culminated in perhaps the greatest return for expenditure ever achieved in any single military operation in the whole history of war, the sinking of the 45,000-ton *Tirpitz*.

On November 12, 1944, thirty-two *Lancasters* set out for Tromsoe Fiord, each carrying one 12,000-pound armor-piercing bomb, and equipped with the precision bombsight. To give the bombs time to accelerate, the attack had to be made from more than 13,000 feet. Not only was the 792-foot *Tirpitz* sunk, but on April 9, 1945, the *Admiral Scheer* and on April 16, 1945, the *Lutzow* were sunk by exactly the same weapons.

The bombing of the Dortmund-Ems Canal tells even more about improved precision and greater striking power, for it was one of the early targets for RAF bombers and also one of the last. On March 5, 1945, the Air Ministry was able to state that the canal was dry on both sides of the safety gates at Ladbergen, the fifth time the Canal had been drained by bombing.

Power of precision bombing had been amply demonstrated. Later attacks were made in daylight which were entirely different from the kind of blast and incendiary night attacks on which the Bomber Command had previously concentrated, but they would not have been possible had the German air force existed in strength at the time.

Consequently it may be said that the effectiveness of precision attack with large bombs was proved but that it became a possibility only after a high degree of air superiority had been secured by the Allies. In gaining that superiority the USAAF heavy bombers had been the major agent.

They had been pursuing their own, different, bombing policy with increasing energy since the moment the first *Fortresses* took off from an airfield in England to strike at Germany. They were using small and medium-size bombs and were achieving accuracy by working in full daylight and fighting their way through enemy fighter opposition.

Theirs was a dual purpose in that they ate into the reserves of the *Luftwaffe* by compelling the German fighters repeatedly to do battle on the largest scale and, at the same time, they damaged and destroyed specially chosen targets such as ball-bearing factories, fuel storage plants and railway marshalling yards.

Enemy oil stocks were rapidly reduced. Over-all oil production was cut to 7½ per cent of the April, 1944, output and aviation fuel production to 3½ per cent. The launching sites of the V-weapons and the experimental stations where work was underway on multiple artillery, jet-driven aircraft and radar were also attacked and kept continuously behind schedule.

American heavy bombers had forced German aircraft to defend Germany and then had shot them down. The Russian front gained heavily from these bombing operations and by 1944 there were only 350 German fighters ranged against the Russians along a 2,000-mile front.

American daylight bombing had drawn out the vastly greater part of the *Luftwaffe's* defensive weight. The destruction of enemy aircraft by the United States Army Air Forces, apart from the American Component of the Tactical Air Force, was almost entirely the outcome of these bombing operations. The enemy aircraft were either shot down by the bombers or by fighters escorting the bombers. The following table gives the claims from the beginning of the United States air forces operations until mid-April.

ENEMY AIRCRAFT DESTROYED OR DAMAGED

Organization	In the Air	On the Ground
8th Air Force	11,231	7,280
15th Air Force	3,949	2,342
9th Air Force	2,277	2,058
12th Air Force	2,913	220
Total	20,370	11,900

More remarkable—and more clearly the outcome of the work of the United States Army Air Forces (especially the

OPERATION FIDO

OPERATION FIDO was a unique means of burning the fog off British airfields for warplane landings in emergencies. FIDO stands for Fog Investigation Dispersal Operations. As the lower photographs show, the fog was literally burned off by flames from petroleum pipelines laid flush with the ground, parallel with the runways. Photo above shows British *Mosquito* bomber landing on airfield with FIDO pipelines in operation on both sides of the runway.

FIDO cleared a path through the fog 100 feet high, 150 feet wide and 1,000 yards long within 10 minutes. During 2½ years of operation, at the rate of about 6,000 gallons per aircraft landed, FIDO units consumed nearly 100,000 tons of gasoline.

A coil of rectangular flexible tubing.
Braided wire covering forms electrical shield over flexible conduit.
Breeze Flexible Tubing, Shielding, Conduit Fittings
Representative of standardized Breeze shielding fittings.
BREEZE MARK

● Breeze Flexible Metal Tubing solves many a design and modification problem by providing easily installed ducts and vents for air conditioning, exhaust or dust collection. Produced in a variety of metals from a continuous strip, Breeze Tubing resists heat and corrosion and is available in a variety of shapes to fit structural considerations.

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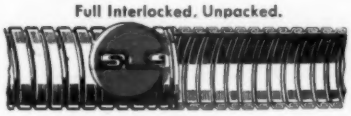

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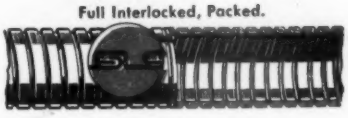


8th)—was the diminution in German air force strength. In the summer of 1941 Germany had 3,300 aircraft or 56 per cent of the whole *Luftwaffe*, employed on co-operating with the German army. By the end of 1943 it had only 18 per cent.

The RAF Bomber Command claimed 759 enemy aircraft destroyed, a figure which reflects the fact that the bulk of the RAF bombing was done at night and without fighter escort. The RAF Fighter Command figure of 6,977 is not directly related to the bombing operations.

After the Normandy landing, both British and American heavy bombers were called in at times to intervene on or very near the battlefield. A counter attack was stopped by this means at Villers Bocage on June 30, 1944, and the advance to the east of Caen in July was preceded by an attack by 1,056 *Lancasters* and *Halifaxes* together with 570 *Liberators* and 318 medium bombers.

Something must be added about certain special bombs used both by the Americans and the British. There are the fragmentation and anti-personnel bombs whose characteristic is that they have a flat scatter of fragments. They were used against airfields but mainly by the medium bombers.

Incendiary bombs were of many kinds. The RAF began with the conventional pattern, but in August, 1944, it introduced a new 30-pound incendiary bomb 21 inches long and 5½ inches in diameter. Its main filling is a solution of methane in gasoline under pressure. Descent of the bomb is controlled by parachute. On impact the striker of the bomb fires the detonator and its flash ignites the priming in a central tube. The priming ignites the thermite and this heats the interior of the bomb, raising still further the internal pressure.

Petrol is then forced through a flexible tube into a valve chamber through the outlet hole in the jet and through a hole in the bottom of the parachute container. As it passes out of the jet the petrol is ignited by the thermite flame from the vent holes in the striker housing. The jet of flame is about 15 feet long and lasts for two minutes.

This bomb was used against Munich on the night of April 24, 1944, by a force of 250 *Lancasters*. It was also used against Stuttgart and Bremen.

Jellied oil phosphorous and various kinds of cluster incendiary bombs have been used extensively by the Allied air forces. One American cluster bomb consists of 165 two-pound, 110 four-pound or 38 six-pound units. The cluster is broken at a predetermined height by a time fuse.

A rocket bomb has also been used by American aircraft for precision bombing from great heights with good armor-piercing effects. It is used with the Norden bombsight and has a super-sonic impact speed.

The cost of the Anglo-American bombing operations against the Germans was 7,997 British and 8,062 United States bombers lost. Coastal Command, whose mine-laying operations may be held to be a part of the bombing offensive, lost an additional 454 aircraft.

The testimony of all who have visited Germany and inspected at close range the results of the Allied bombing confirms that it was a major factor in bringing victory and in reducing casualties of land and sea forces.

But heavy bombing is a highly complex military process. The aircraft, the bomb, the strength of the force employed, the sighting and dropping arrangements must all be related to the target. When all these variables are correctly related, heavy bombing can paralyze a country's war-making power. END

The Gas Turbine in Aviation

(*Continued from page 48*)

cruising power range, is a very efficient means of converting fuel energy into shaft power. However, its application to aircraft is complicated by many difficult problems, among which are the necessity for supercharging at high altitudes, severe vibration, excessive weight installed as compared with dry engine weight, and high nacelle drag and engine cooling power losses.

For medium range and long range aircraft, the most important problems are probably the reduction of nacelle drag and engine cooling losses. Airplanes designed for low speed operations can afford to have a large part of the plane's parasitic drag absorbed in engine nacelle and engine cooling losses. This is distinctly not the case with long range and high speed aircraft.

The reciprocating engine presents a dismayingly large frontal area when

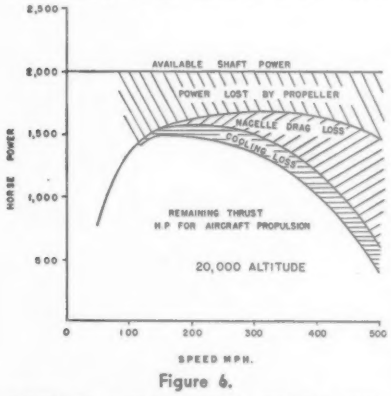


Figure 6.

placed in a wing nacelle and the total profile area of power plant frequently exceeds that of the fuselage. Similarly, the reciprocating engine requires large volumes of cooling air that must be forced around the cylinders of air-cooled engines or through the radiators of liquid-cooled engines as well as through numerous accessories and oil coolers. Figures 6 and 7 show the power losses at different airplane speeds for a typical 2,000-h.p. engine installation complete with propeller and installed in a wing nacelle. The remaining available power under any but low speed flight conditions is greatly reduced by these losses. Figure 6 shows typical losses for maximum engine power at all speeds, and Figure 7 shows the average losses for the same engine under flight conditions in a large airplane with a top speed of 400 m.p.h. Higher speeds would still further accentuate the losses. Also shown on Figure 7 is a fuel rate curve based upon the net thrust horsepower of the power plant after all power plant losses have been accounted for.

The axial flow jet engine of Figure 2 is a slender package capable of delivering almost constant thrust at all speeds from take-off to dive maximum. Throughout this speed range, fuel is burned at practically a constant pounds per hour rate and changes in speed have but little effect on thrust or fuel consumption. Further, the jet propulsive efficiency is approximately proportional to speed, as shown in Figure 3. These factors will lead to the use of jet engines in high speed aircraft. At low air speeds, fuel consumption rates are exorbitant when compared with propeller-driven aircraft.

To offset the disadvantage of low efficiency at low speeds, the jet engine delivers a lot of power for very low installed power plant weight in its proper flight speed range. Cycle efficiency, while not good is fair, which means low fuel cost per thrust horsepower at very high speeds. Furthermore, the engine's diameter is small enough to permit buried installations in the wings of any but the smallest planes.

The most suitable applications for jet propulsion appear to lie in speed ranges where compressibility effects are the principal unknowns; supersonic problems

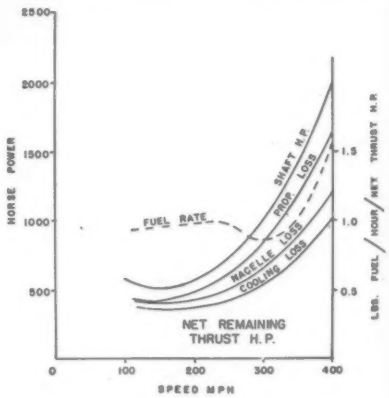
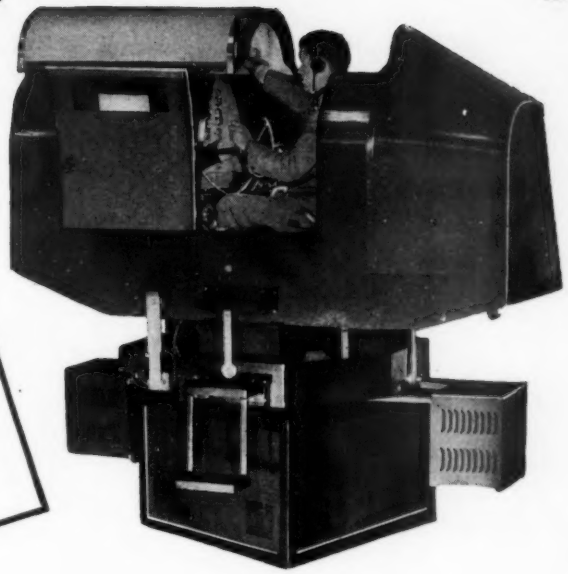


Figure 7.

are fairly well known from ballistics and low speed flights has been well explored, leaving the natural flight speed range of the jet engine a large blank.

To project our present designs somewhat into the future and estimate possible trends, Figure 8 has been prepared. The solid curves represent the power required and power available characteristics of an extremely fast high altitude single seater of current reciprocating engine design; the dotted curves are for a jet-propelled plane of equal gross weight



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and wing area but in which it is assumed that the drag has been reduced by one half through refinements made possible

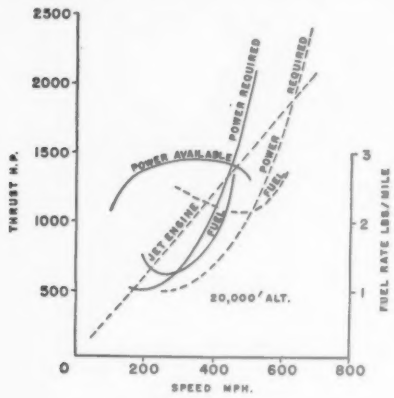

Figure 8

by the use of the jet engine instead of the reciprocating engine.

The maximum speed at 20,000 feet altitude increases from 460-m.p.h. for the conventional plane to approximately 600 m.p.h. for the jet fighter, assuming that compressibility effects are absent, but the speed increase does not bring with it a better cruising radius even when proper allowance is made for the larger fuel tanks that are permitted by the lighter weight jet engine. The lowest fuel rate in pounds per mile at this altitude for the jet plane is almost double that of the conventional aircraft.

By increasing the flight altitude of the very low drag jet plane of Figure 8 to

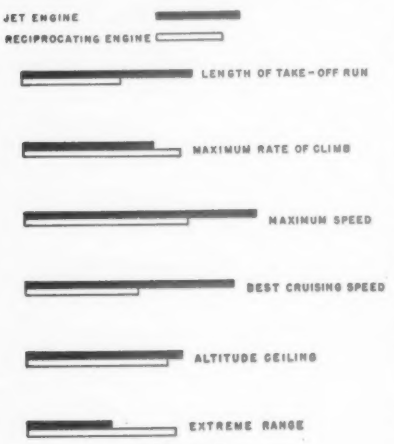

Figure 9

30,000 feet, the maximum speed may decrease slightly due to compressibility effects but the best cruising speed is increased by about 50 m.p.h. with a fuel consumption per mile about 40 per cent greater than the conventional airplane. The conventional aircraft with a high maximum speed is able to throttle back to a 270 m.p.h. cruise for maximum range. The jet plane will have to fly at over 500 m.p.h. for maximum range—and high speed always means very large power expenditures, a point often overlooked by rocket and jet enthusiasts. However, this jet plane would fly the same course in half the time that the conventional aircraft would take and could therefore afford a reduction in range for interceptor service and related missions.

The above estimates are based upon the rather optimistic assumption of a jet plane with only one-half of the drag of the plane with a conventional power plant installation.

Figure 9 is a bar chart comparing the relative merits of a jet fighter and a conventional fighter with regard to take-off run, rate of climb, and extreme range. The jet-propelled aircraft is superior to the conventional power plant job in all particulars except take-off, climb, and range. By using a jet engine of 50 per cent to 70 per cent greater thrust than in this example, the take-off run would be reduced to about the same as the conventional fighter, the climb and ceiling would be greatly increased, and the cruising speed and maximum speed would be increased slightly, all at the expense of a heavier power plant and a further serious reduction in range.

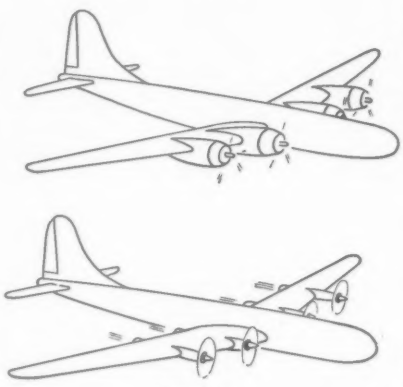

Figure 10

These comparisons are also true for large aircraft such as transports and bombers, although in the case of the bomber particularly it is even more difficult to achieve really large reductions in drag because of the constant large increments of drag due to armament and navigational devices. Substantial reductions in drag can be effected but not enough to result in jet versus piston engine fuel rates of the order indicated in Figure 8.

The gas turbine geared to a propeller, shown in Figure 4, has the advantages of the jet engine with respect to drag reduction and ease of installation while at the same time retaining the high propulsive efficiency of the propeller at low speeds. The present limit of usefulness of the geared propeller turbine at high flight speeds is set by the characteristics of available propellers which lose out quite rapidly in efficiency above 500 m.p.h. Research on propellers is necessary for several reasons, however, and propeller manufacturers are hopeful that the good efficiency range can be extended to considerably higher speeds.

The principal and immediate advantage of the geared propeller gas turbine is a large reduction in airplane drag. Figure 10 shows two large airplanes, one with conventional engines installed and the other as it would be with turbines. The contrast is striking, both in appearance and drag. Overall power plant performance for the gas turbine with geared propeller is shown in Figures 11 and 12, which should be contrasted with Figures 6 and 7 for the piston engine power plant. It is interesting to note that the pure thrust power obtained from the turbine exhaust is approximately large enough to offset engine nacelle drag and ordinary propeller losses under normal flight conditions. Therefore, as an approximation, the shaft power output of a geared turbine of this type is roughly equivalent to its net thrust horsepower as a complete power plant under flight conditions. Figure 12 should be compared with Figure 7 for a direct comparison of total power plant losses of conventional engine power

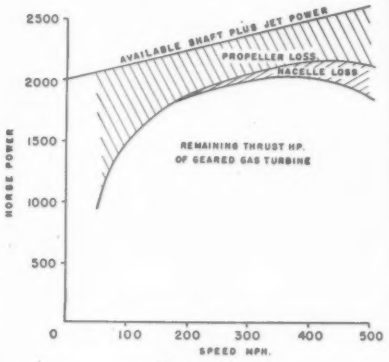

Figure 11

plants and geared turbines with propellers.

It is possible to make a choice of the division of power outputs of a turbine propeller unit between jet exhaust thrust and the propeller shaft. For example, for a very high speed airplane that must still have a good take-off characteristic, 50 per cent of the power might be used in jet thrust and the remainder in the propeller. For ordinary applications, however, between 20 per cent and 25 per cent of the available energy should remain in the exhaust jet, the turbine shaft recovering

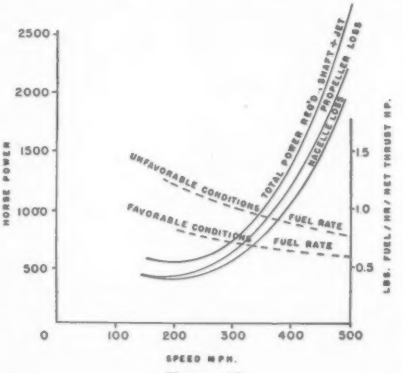

Figure 12

the remainder. Thus, for the example chosen here, most of the energy is absorbed by the propeller with excellent overall power plant performance at low flight speeds, and with fuel economy at

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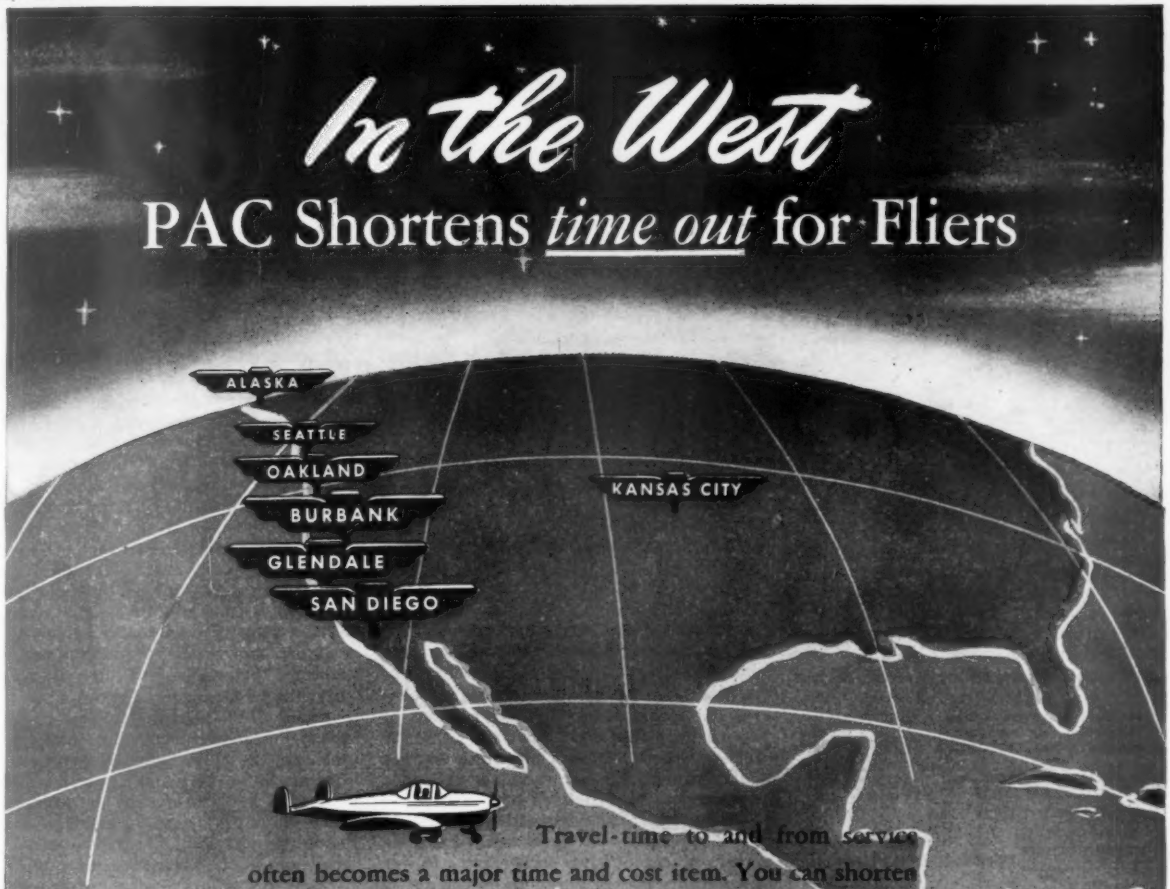

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high power levels that is quite superior to the conventional power plant.

This type of power plant is equally adaptable to fighters or large airplanes. The improvement in fuel efficiency with increasing air speed and power results in

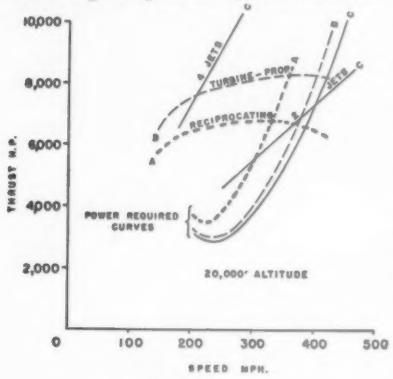

Figure 13

somewhat higher cruising speeds than for aircraft with reciprocating engine power plants. The decrease in available power at higher altitudes makes it necessary to install gas turbine power plants that may have considerably more power at sea

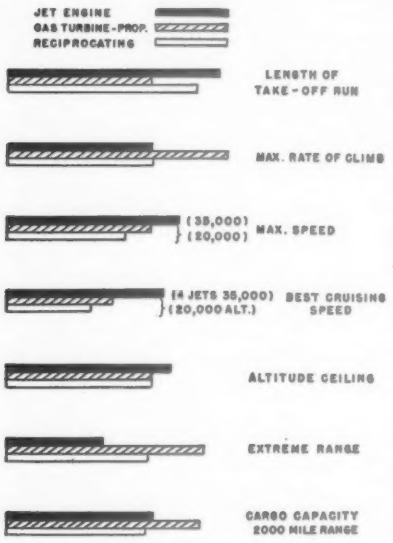

Figure 14

level and for low altitude climb than is now considered normal in airplane design. This is an advantage rather than a disadvantage, however. A propeller able to absorb the turbine's shaft output at 20,000 feet or 30,000 feet can handle efficiently the greatly increased output of the same turbine at sea level, due to the denser air at low altitudes. Thus a turbine power plant with a rating equal to that of a supercharged conventional engine at 20,000 feet altitude might have a take-off thrust at sea level 60 per cent in excess of the thrust of the conventional engine. A much shorter take-off run than normal is therefore possible, and rate of climb is greatly superior to the conventional aircraft.

The field of usefulness of the gas turbine with propeller then extends to all aircraft requiring engines of greater than perhaps 1,000 to 2,000 h.p., and designed for all speeds up to and in excess of 500 m.p.h.

The total thrust horsepower requirements of a typical large four-engined airplane at 20,000 feet altitude are shown in Figure 13. Curve A is for the plane with reciprocating engines and includes all power plant drag losses but does not include propeller efficiency. Curve B is for the same airplane but with gas turbine engines geared to propellers (see Figure 10). Curve C is for a jet-propelled aircraft similar in appearance to the turbine-propeller plane but without the propellers. The gross weight in each instance is assumed to be 120,000 pounds and power plant plus fuel weights are held constant.

The conventional engine installation is four engines supercharged to 2,000 h.p. each at 20,000 feet. In the jet-propelled version, four 6,000-pound static thrust engines are used. This will give 24,000 pounds take-off thrust — approximately equal to the take-off thrust of the plane with reciprocating engines. Once in flight, two of the jet engines will be shut off for cruising under 25,000 feet altitude and the other two will be used for propulsion. In the gas turbine geared propeller version, four engines capable of delivering 2,000 shaft h.p. each at 20,000 feet are used. At take-off, these engines will deliver 3,200 h.p. each. A propeller designed to absorb 2,000 h.p. in the low density air of 20,000 feet altitude can handle 3,800 h.p. at sea level with the same level of propulsive efficiency. Power availability curves for these power plants are also shown on Figure 13. Power availability is shown for flight with either two or four jet engines in use.

Thus, at take-off the three versions appear as in the table below.

	Gross Wt. (lb.)	Installed Power Plant Wt. (lb.)	Fuel Wt. (lb.)	Take-Off Thrust (lb.)
Conventional	120,000	20,800	40,000	28,000
Turbine Propeller	120,000	15,200	45,600	44,000
Jet Propelled	120,000	8,000	52,800	24,000

Cruising conditions are shown below. Jet cruising is on four engines at 35,000 feet and on two engines only at 20,000 feet; fuel consumption with four jet engines operating is prohibitive for any operations other than at take-off or very high altitudes. Cruising with four gas turbine propellers in use is tabulated, and also with two turbine propellers in use and two feathered. A suitable drag allowance has been made for the feathered propellers.

Cruise Conditions (20,000 feet)	Best Cruising Speed m.p.h.	Miles per lb. fuel	Extreme Range Miles
Conventional	250	0.120	4800
Turbine Propeller (4 engines)	300	0.125	5700
Turbine Propeller (2 engines)	280	0.145	6600
Jet Propelled (2 engines)	350	0.050	2650
Jet Propelled (4 engines 35,000 feet alt.)	460	0.066	3500

The sensitivity of the gas turbine propeller to partial load operation is seen in table above. An 18 per cent increase in range is obtained by operating two engines close to full load and maximum efficiency rather than operating four engines at less than half load. This is a fundamental difference that exists between turbines and reciprocating engines and it makes necessary a careful selection of turbine ratings for any given application if maximum fuel economy is to be gained. The same conditions are true of jet propulsion engines and it is profitable to operate close to 80 per cent of full rating of the turbines either by shutting down excess power units or going to a sufficiently high altitude to decrease the maximum rated output to a value near the required flight power. In the case of jet propulsion, since high speed and high propulsive efficiency go together, very high altitude operation is essential to maximum flight economy.

The general characteristics of the three airplanes described in the above tables are compared by the bar charts of Figure 14. It is interesting to note that the gas turbine propeller airplane is superior to the conventional aircraft on every count with the exception of altitude ceiling, where they are about equal if the reciprocating engines are turbo-supercharged. Since turbine propeller fuel economy and installed power plant weights are both superior to those of the conventional engine, the long range and short range load-carrying abilities of the turbine propeller aircraft are superior to the conventional one. On the other hand, the jet-propelled aircraft has a very light power plant installation and can get off the ground for very short flights with about five tons more payload than the conventional aircraft and about three tons more than the turbine propeller version. However, jet propulsion requires so much more fuel than other types of power plant that at about 2,000 miles extreme range the jet plane loses out to the reciprocating engine and is far behind the geared turbine in payload carrying ability.

As was found in the case of the jet-propelled fighter, the jet bomber or cargo plane must be limited in use to relatively short range, very high speed, high altitude operations which can stand the expense of high fuel costs, until we have learned more about the aerodynamics of flight at speeds over 500 m.p.h. The gas turbine with a geared propeller, however, has immediate applications in all classes of service where requirements are much above 1,000 h.p. at usual flight altitudes, and should be ready for use when aircraft designs require 10,000 h.p. or more in a single power plant unit. END

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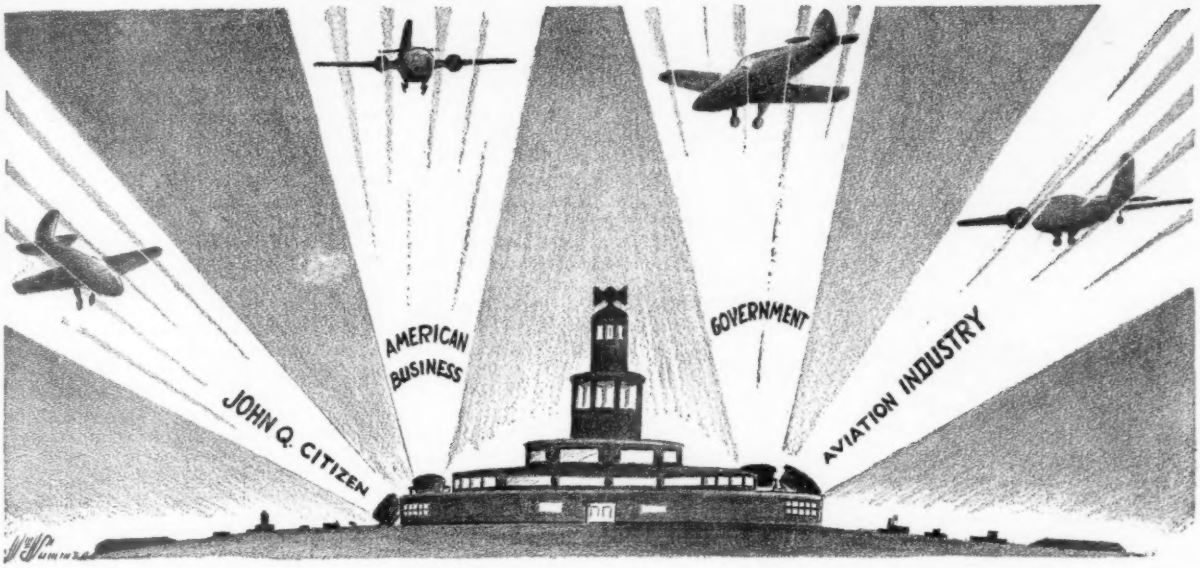

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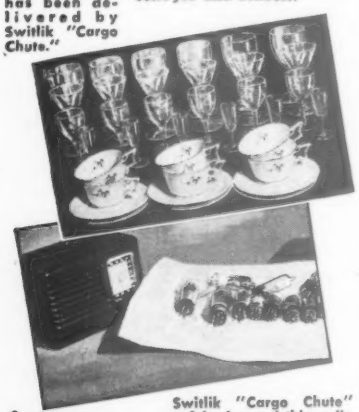

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(*Continued from page 34*)

this to say about minimum requirements for fixed-base operations:

"Procure a tract of land as near the city limits as possible. The tract should be level, or fairly so, and anywhere from about 60 to 150 acres. If possible, and the price is right, select your site where additional land is available for future expansion. However, to get your start, a flight strip 2,400 feet long and 300 feet wide will be sufficient and comparatively inexpensive. Cross runways can be added as business warrants. Get it at a sufficiently low price to keep within your finances and enable you to operate it at a profit."

Neither Taylorcraft nor anyone else can set an absolute minimum of money with which to start a small airport and keep it going until it begins to pay off. Two governing factors which should be the beginner's first consideration are the potentional number of students to instruct and private planes to store and service. If the owner can begin instructing at once, his airport income begins immediately. If he has tie-down facilities for locally-owned planes, rentals are another source of income. He can even rent or lease land on his field for construction of individual hangars by private owners. It would be well for the lone owner-manager to plan to support himself for a few months and pay his airport expenses while he is out drumming up business.

Arbitrarily taking the $2,000 which a veteran can borrow and guessing at the best places to put it, the beginner's books may look like this:

Two months rent on 50 acres	$ 50
Down payment on plane, insurance and one month's payment	700
T-hangar and makeshift office	600
Fuel and incidentals	50
Preparation and marking of field	100

This adds up to $1,500, leaving $500 to play on if the veteran has no other income or savings. It looks like a slim prospect, but many successful operators have started on less. Of course, the variations in individual circumstances are limitless. Certainly no operator should start on less capital than that except in unusual circumstances. Some say $20,000 is an absolute minimum for a successful beginning.

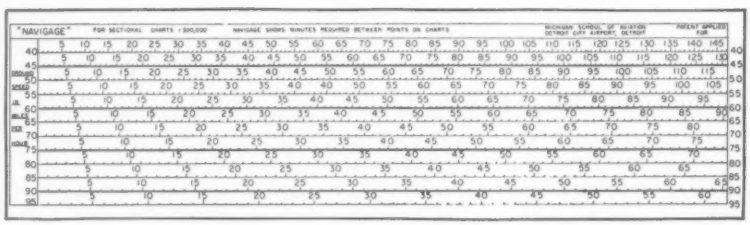
The owner-manager must be willing to do most, if not all, of his work. Veterans of the Air Forces must throw their minds completely out of military gear. Nothing approaching the expensive, sometimes wasteful operation of war planes will be possible. The beginner pilot-manager-airport-owner can't walk out of his office and step into a plane already serviced by a dozen crewmen. He must invest hard work as well as his money, his reputation and his business ability.

Lack of knowledge of the initial work required need be no barrier. For the serviceman, the Armed Forces Institute, Madison, Wis., has prepared valuable correspondence courses. One such course which should prove particularly valuable is entitled "the Small Business: Organization (course 1), and Operation (course 2)".

Perhaps the most complete coverage of the subject of airport construction and operation is provided in the more than 100 pamphlets prepared by CAA, a free list of which is available. Here are the subjects they treat:

Standard airport lighting, airport administration and terminal buildings, wood frame hangars, steel frame hangars, typical hangar plans, control towers, airport construction and drainage; runway surfaces, airport fueling facilities, seaplane facilities, approach standards, runway marking, airport management, survey material on approach protection and runway paving specifications.

There also are available market surveys from Federal and private sources by which potential customers for planes and service might be estimated for a given territory. These surveys are available


"NAVIGAGE"
NAVIGAGE SHOWS MINUTES REQUIRED BETWEEN POINTS ON CHARTS
MICHIGAN SCHOOL OF AVIATION DETROIT CITY AIRPORT, DETROIT

SIMPLIFYING NAVIGATION

A SCALE that automatically converts miles into minutes, the Navigage, devised by A. W. Bull and Graham Prince of the Michigan School of Aviation, Detroit, is a transparent, plastic rule, four x 13 inches long and .030 inches thick.

Placed over a sectional chart with the known ground speed line over the track line, the Navigage gives an accurate time check between reference points. It is made in three speed ranges for the 1:1,500,000 sectional charts.

POST WAR AVIATION OPPORTUNITIES
Bulletin

VOLUME 1 NUMBER 11

Fixed Base Operation— Its Meaning and Opportunities

(PART 3)

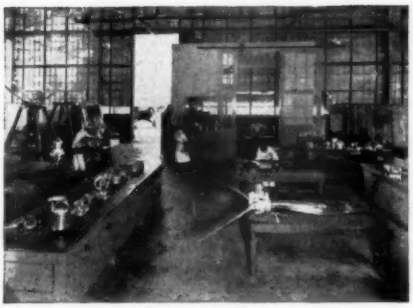
The previous Bulletins on fixed base operation dealt with the meaning of the term and its scope of activities as a source of postwar income for members of the air forces. In this Bulletin we will consider some of the steps necessary for a prospective operator to establish himself in business. This usually means seeking a concession.

CONCESSIONS

The first step, of course, is for the individual to determine his own qualifications. That is, whether he is a mechanic, pilot, navigator, etc. This, together with any past business experience, will determine in part whether he should work for someone else in fixed base operation or seek establishment in business for himself. Next should be the thought of capital. The amount needed naturally depends on the size of the selected airport and the extent to which it is planned to operate. Some may increase their capital by pooling with crew members or shipmates.

APPLICATION

To obtain a lease or concession at an airport, personnel must present a proposition to the City Council (presuming it is a municipal port). The proposition should indicate the facilities and type of service which you propose to establish and the amount of rental which you desire to pay for the concession. The authorities will consider your proposal, along with others, and will determine whether they will give a concession to one operator or two or three.



Scene in a Pacific Airmotive repair shop showing mechanics balancing and adjusting propellers. Airlines are good customers for this type of service.

If interested in gas and oil servicing, personnel should obtain, prior to their formal presentation, a source of supply from an oil company, together with type of equipment and facilities they expect to install. The oil company would undoubtedly assist in obtaining the concession or franchise from the Council and lend support in many ways.

DEALERSHIPS

Those wishing to obtain dealer rights for small planes should contact the manufacturer. Some definite plan for sales promotion should be presented, together with a financial statement and a brief summary of past experience.

OPPORTUNITY

F. A. Locher, general manager of one of the oldest and largest air service operations in the United States, with an operating chain extending from Alaska to San Diego, believes that fixed base operation offers many postwar employment opportunities to air force members.

It is his opinion that the development of fixed base operation is only beginning and that peacetime commercial flying will afford hundreds of new opportunities for the war-trained skill of air force members.

(Note: This is the third of three Bulletins on the subject of fixed base operation and its postwar opportunities for air force members.)

The eleventh in a series of bulletins designed to acquaint ground and flight personnel of the Army, Navy and Marine Air Corps with new developments in the field of commercial aviation. Union Oil Company does not believe the war is won, but we do think many members of the air forces are wondering what they will do when peace comes. We believe they will be interested to know of any opportunities which exist for them. Inquiries are welcome, and we will be glad to furnish information to interested personnel. Address—Aviation Dept., Union Oil Company, Room 700B, 617 W. Seventh Street, Los Angeles 14, California.

AVIATION DEPARTMENT
UNION OIL COMPANY
OF CALIFORNIA
76

A Problem in Multiplication

Take the case of John Smith, average American:

For over three years now, he's been buying War Bonds through the Payroll Savings Plan. He's been putting away a good chunk of his earnings regularly—week in, week out.

He's accumulating money—maybe for the first time in his life. He's building up a reserve. He's taking advantage of higher wages to put himself in a solid financial position.

Now suppose *everybody* in the Payroll Plan—everybody who's earning more than he or she needs to live on—does what John Smith is doing. In other words, suppose you multiply John Smith by 26 million.

What do you get?

Why—you get a whole country that's just like John Smith! A solid, strong, healthy, prosperous America where everybody can work and earn and live in peace and comfort when this war is done.

For a country *can't help* being, as a whole, just what its people are individually!

If enough John Smiths are sound—their country's *got* to be!

The kind of future that America will have—that you and your family will have—is in your hands.

Right now, you have a grip on a *wonderful* future. Don't let loose of it for a second.

Hang onto your War Bonds!

BUY ALL THE BONDS YOU CAN

KEEP ALL THE BONDS YOU BUY

ZIFF-DAVIS PUBLISHING COMPANY

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

even on the county level through the use of "County Basic Data Sheets," published by the U. S. Department of Commerce. The war has prevented preparation of up-to-date sheets in many cases but figures as of 1940 are available. These go into considerable detail and would be helpful in site selection.

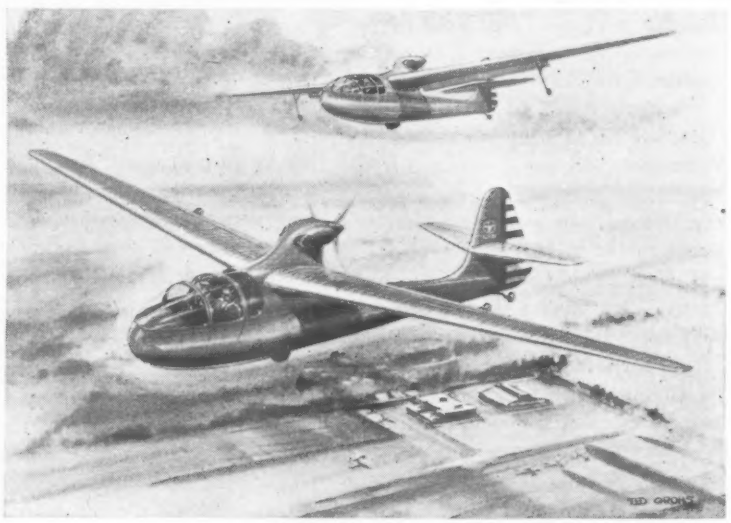
Sales Management Magazine, 386 Fourth Avenue, N. Y., publishes an annual survey of buying power for the whole country. Various estimates of the airplane market after the war have been made, including "Tomorrow's Customers for Aviation" by Crowell-Collier Publishing Co., Philadelphia; the Whan survey made by Dr. F. L. Whan of Wichita, Kans., and surveys made by *Fortune* and *Esquire* magazines. The Collier survey sampled urban dwellers to determine their plans to buy airplanes; Whan sampled both rural and urban residents of Kansas.

Directly on the subject, and probably of most interest to the prospective airport operator who would sell planes and service, is a study made by the McGraw-Hill Publishing Company for *Aviation* magazine. It is listed elsewhere in this article.

Similar preliminary investigation has been made with respect to bases for seaplanes. The procedure is as simple, and, in most cases, less expensive than establishing a modern flying field. The CAA's pamphlet on the subject, "Seaplane Facility Plans," has drawings, plans and suggestions for ramps and floats which range in cost from a few hundred to several thousands of dollars. On any good stretch of river, any moderate-sized lake, along the shores of all the Great Lakes, and on protected ocean harbors, this kind of a base is likely to prove a profitable venture. The Great Lakes region, in particular, is a great, untapped market for water-borne planes and for service to their pilots. No region on earth offers more interesting possibilities to the pleasure flyer except, perhaps, the new lakes in the Tennessee Valley.

Operation of a field presumes that the operator is qualified as a pilot. The CAA is now issuing civilian certificates on the basis of military competency while the applicant is still in service. A signed log book, listing the pilot's time, or a letter from the proper commanding officer certifying his experience, will be accepted by the CAA inspector wherever and whenever the soldier can meet him while in this country. Ratings (instrument, instructor and horsepower) are awarded on the same basis. The only written examination required is on the air traffic rules. The operator who can instruct, fly cross-country and do other kinds of flying for hire, is, of course, in better position than a non-flying manager to start a modest, one-man operation.

There are no rigid Federal "regulations"



NEW LIGHTPLANE DESIGN

THE VJ-21 is a new light aircraft based on sailplane design principles. The full cantilever, high aspect ratio wing craft will be powered with a 65-h.p. Lycoming engine to provide an anticipated cruising speed of 110 m.p.h. and a top speed of 135 m.p.h.

The two-place pusher plane embodies a novel landing gear, a single brake-equipped main wheel, permitting landing on rough terrain and eliminating ground looping. The airplane thus will assume the same angle of attack for taking off and landing as when in flying position. Two small wing wheels swing downward to keep the wings level while taxiing. Controls are conventional. It is expected to sell at less than $2,000.

Jarvis Manufacturing Co., Glendale, Calif., is to produce the all-metal monoplane, with the prototype scheduled to fly in September. It was designed by Valmar Jensen, well-known sailplane designer.

"I'm sorry, Sir, Aero 5677 does not answer!"

Radio to keep your feet on the ground

The airy gentleman descending from the skies above has that carefree look partly because his plane is equipped with a Hallicrafters Skyfone. Skyfone is the latest in the line of Hallicrafters built communications equipment that has distinguished itself on land, sea and air for rugged dependability under the most difficult conditions. Hallicrafters Skyfone will greatly increase the safety factor in postwar flying. There will be a model for you—whether you fly for business or pleasure.

hallicrafters *Skyfone*

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THE HALLICRAFTERS CO., CHICAGO 16, U. S. A., WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF SHORT WAVE RADIO COMMUNICATIONS EQUIPMENT

on the construction of an airport. Some state aviation bodies have minimum runway length requirements and the CAA wants every landing field to be of such size that operations will be safe. To this end, it advises and assists in the selection of the site, layout of the runways, the drainage problems and, if required, the lighting. Except during wartime, when only those fields can operate which are designated by proper authority, anybody can operate airplanes from any field. The intelligent operator will be guided by the requirements of safety—including obstruction-free approaches, reasonably level runways, good drainage and a proper surface, whether sod or paving.

The CAA divides airports according to length of runways into five classes. We are discussing only the two smaller classes, 1 and 2. It decentralizes its advisory services into seven regions, with a supervisor of airports in the headquarters of each in New York, Atlanta, Chicago, Kansas City, Fort Worth, Santa Monica and Seattle. The Eighth Region is Alaska, with headquarters at Anchorage, and the Ninth is Hawaii, with headquarters at Honolulu. The CAA's airport service is directed principally to communities with landing field problems but is available also to individuals.

More than half the states now have special organizations to handle aviation matters. Working with the Federal Government, these commissions, boards or bureaus also advise with their citizens on construction and operation of airports.

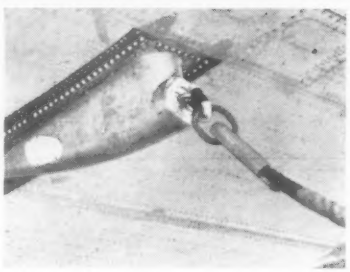
SKYTRAILER

RECENTLY removed from the AAF secret list is the newest, fastest and heaviest glider known to the Air Transport Command—an engineless Army *Skytrain*. The big transport, with its empty engine nacelles capped by hemispherical wooded noses, incorporates a specially-fitted tow release mechanism attached under the fuselage for the standard, 350-foot nylon tow rope.

Officially designated XCG-17, the plane was modified after the ATSC at Wright Field made known the need for a glider capable of withstanding the higher speeds generated by a *Skymaster* as tow plane.

Tests were first conducted in the summer of 1944 at Wilmington. Two *Skytrains* went aloft coupled by a tow rope, with the lead, or tow plane, providing most of the power. At test altitude the towed transport cut its engines, feathered the propellers and proceeded to go through every known glider test. Later it cut loose and glided to a perfect spot-landing.

The weight of the XCG-17 glider is about half that of a conventional



Skytrain. The radio and forward baggage compartments were eliminated and a new floor added to permit loading cargo farther forward to compensate for the loss of engine weight. Four hundred pounds of lead shot added to the nose as ballast was later removed when tests showed it was not needed. Its long, flat glide angle (a 14-to-one ratio) exceeds that of any conventional AAF glider. It is the only glider not requiring ballast when flown in minimum weight conditions and its seven-ton payload is the greatest known heretofore. Permissible towing speed is 270 to 290 m.p.h. as compared with the top speed of 200 m.p.h. with regular cargo gliders.

Americans take to the "alley garage" where some of the best automobile mechanics in the world are to be found. A good airplane and engine mechanic or a group of specialists from Army or Navy maintenance forces could easily establish such an aircraft service, perhaps by combining their talents and resources. The CAA, in all probability, will grant certificates to mechanics while they are still in the service. Already changes in the regulations have been considered by which those who have specialized in instruments, propellers, supercharged engines, etc., may be licensed first in their specialty.

Position of the field, business-wise, is highly important. A site alongside a well-traveled road is preferable. The less effort required to reach it, the better. Anything within reason that gets the new airport in the news is helpful, and newsworthy events continually happen at airports. The more your name appears, the more prospective customers will hear about you and the better your business will be. Put your own name on the business and then build up the business to be worthy of it—that's publicity-wise advice.

Just how to do that is best summed up by Dick Depew, another old-timer in the flying business, who has been operating airports and airplane sales businesses longer than any other person in the country. Depew, now manager of special projects at Fairchild Aircraft, likes "Do's" and "Don'ts" capsule advice.

"Do," he says, "make the surroundings attractive, clean and convenient. Provide fast and courteous service.

"Do make the customer welcome. Show him his patronage is desired.

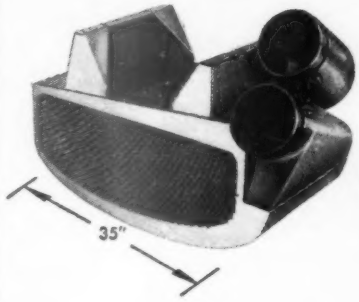
"Don't neglect housekeeping."

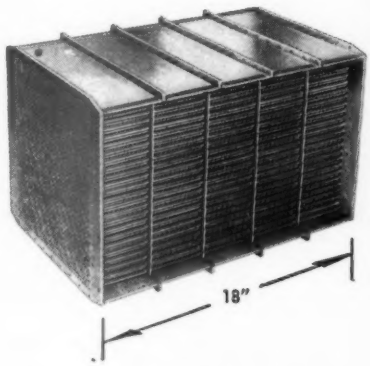
This may seem rather superfluous advice. But Depew knows. He has seen airport operators ignore and almost insult potential customers. This sloppy salesmanship is usually paired with a dirty and inefficient airport and it has caused the ruin of many a business. Only the almost fanatic interest of people in flying has made such conditions endurable. But though some airports have succeeded in spite of dirt and indifference that day is past. Aviation hereafter must conform to all rules of successful business enterprise and the prospective operator had better plan it that way.

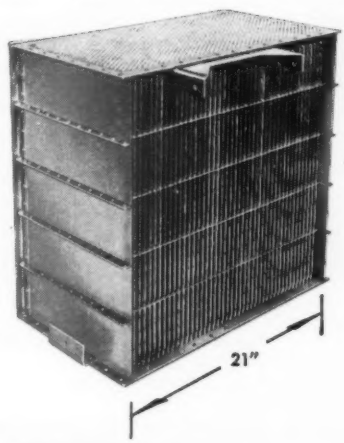
Airports hereafter must be pleasant places. Flying weaves a bond between people that promotes social intercourse. The business is new, and people like to sit and talk about new planes, new ideas, and new things they have learned about piloting. There must be an attractive, or at least clean and comfortable place to lounge and talk and wait.

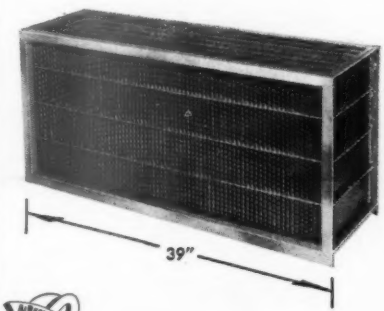
A place to eat is a "must." This can be modest or lavish but it must be clean and attractive. Food is a common denominator and it can play an important part toward increasing the revene of any airport.

Flowering trees and bushes can enhance the attractiveness of an airport. A properly landscaped airport, offering its specialty in beauty and food, will certainly have the jump on the airport that









1,000,000 HOURS of combat performance already logged for AiResearch Intercoolers

THE *ONLY* COMPANY THAT CAN CLAIM SUCH A RECORD OF SERVICE

AiResearch is manufacturing supercharger Intercooler units for the P-38, the P-61, the B-17 and the B-29. These ships alone have logged well over a million combat hours, all trouble-free insofar as AiResearch Intercoolers are concerned. And AiResearch has designed and built numerous other models equally successful.

AiResearch designed the *first* mechanically assembled all-aluminum, corrosion-resisting Intercooler successfully put on a production line basis. The tubes are jig assembled and mechanically fastened for accurate control of dimensions. This method helps make them mechanically strong enough to withstand terrific back pressure.

Both round and flattened tube Intercoolers are standard products of AiResearch. The company's latest development is a flattened-dimpled tube unit used on the B-29, which has shown a remarkable increase in effectiveness and as much as a 40% reduction in cooling drag. Weight has been continually decreased. Intercoolers today weigh 30% less than earlier models.

These Intercoolers are tested in the AiResearch Laboratories under actual conditions of heat, cold and altitude. Lab performance and actual performance have been remarkably near the same. This experience in designing, testing and manufacture is available to other aircraft manufacturers and engineers who have an intercooling problem needing solution.

ARMY E NAVY

AiResearch — manufacturers of AIR CONTROL equipment Cabin Pressure Regulating Systems • Engine Oil Cooling Systems • Supercharger Aftercooling Systems • Temperature Control Systems • Engine Intercooling Systems • Automatic Exit Flap Control Systems.

AiResearch
MANUFACTURING COMPANY
LOS ANGELES • PHOENIX
DIVISION OF THE GARRETT CORPORATION

has the appearance of a trash dump.

Novel buildings, especially when they conform to the architecture of the region, can be planned from the very beginning so that they may be expanded in size and function as the business grows. There are even distinctive souvenirs which can make an airport notable, such as the famous cross stones found in Virginia, the fluffy angora goat rugs in Texas, Indian products in the Southwest and semi-precious stones and jewelry at other places. Remember that people who use airplanes are sure to be enthusiastic travelers. They might fly out of their way to visit an Ozark mountain landing strip where the cornbread-and-greens are nationally famous. If you're a practical, unimaginative, hard working guy with little time for such fumadiddles, give that problem to the wife, your mother, sister—or the boys at the corner drugstore. END

Salvaging Our Surplus Warplanes—in the U. S.

(*Continued from page* 45)

total, or 7,243, were combat planes but they represented two-thirds of the total original cost of all surplus planes—$1,085,127,000.

SPB's job is complicated by the paradox that the planes which originally cost the most are worth the least as surplus property.

Converting fighter planes into civilian "limousines of the air" is far too expensive. Curtiss-Wright estimates show that the cost of converting a *Warhawk* to civilian flight purposes would be roughly $25,000, with another $25,000 added annually for maintenance and operation.

Similarly, the conversion of Army and Navy transport and cargo planes is extremely costly. The cost of converting a military DC-3 for civilian passenger service, for example, ranges from $40,000 to $90,000 plus an "as is" purchase price of $60,000. The pre-war DC-3 was priced new at from $110,000 to $125,000. The airlines undertook such costly conversions because of heavy wartime traffic volume and the absence of new planes. It is doubtful that the airlines will attempt to convert many of the thousands of C-47's which will become surplus in the future.

In general there are three broad outlets for the disposal of surplus aircraft—sales for post-war civilian flight purposes; for educational and laboratory use, and scrapping and salvage. Few, if any, of the combat planes will be sold for flight purposes unless they are disposed of abroad to foreign air forces and this is not now contemplated by SPB. The vast majority of combat aircraft appear destined to be scrapped, salvaged or distributed to schools. SPB disposal statistics eloquently underscore the difficulty of disposing of combat planes compared with useful civilian types. Aircraft sales figures as of June 15, 1945, are:

Type	Declared Surplus	Original Cost	Sold or Leased	Sales Receipts
Small planes, civilian type..	8,995	$30,250,000	8,283	$11,413,000
Transports...	2,999*	$163,623,000	408	$5,880,000**
Military trainers	20,080	$470,343,000	3,244	$3,794,000
Combat planes	7,243	$1,085,127,000	10	$164,700
Total	39,317	$1,749,343,000	11,945	$21,251,700

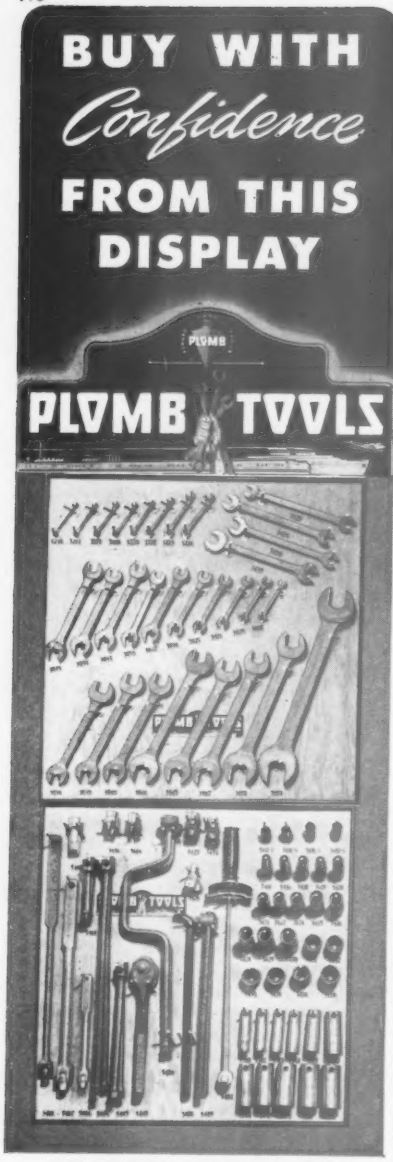
* Some cannot be certificated by CCA; others are being flight tested; a number are damaged or non-flyable.

** Does not reflect receipts from leases.

SPB classifies surplus aircraft in two categories—useable and unuseable planes. Both must first be declared surplus by Munitions Assignment Board and then distributed to the 57 storage fields operated throughout the country by the Reconstruction Finance Corporation which serves as the disposal agency for SPB.

At the RFC storage fields the unuseable planes are offered for sale to educational institutions for non-flight purposes; for the salvaging of engines, instruments and other component parts; for outright scrapping to recover aluminum and other metals. The vast majority of combat planes will follow this disposal route.

Useable aircraft, largely trainers, trans-



...AT BETTER DISTRIBUTORS EVERYWHERE *

Advanced design, dependability, high quality . . . these are some of the advantages you get when you choose your tools from the complete Plomb line.

You'll find it pays to deal with the distributor who features this display, too. It identifies a house that takes pride in quality merchandise and dependable service. Make the Plomb distributor your tool headquarters.... Plomb Tool Company, 2219 Santa Fe Avenue, Los Angeles 54, California.

* 2 of the 14 Standard Type Plomb Display Boards

PLOMB
FINE HAND TOOLS

SECTIONAL AIR MARKERS

PORCELAIN enameled steel segments have been developed as airway markers by Carnegie-Illinois Steel Corp. They can be assembled on rooftops near the center of towns or cities, indicating direction and distance to the nearest airport.

A black background with yellow chrome characters is the most visible color combination. The signs should be placed so as to be visible at any angle from a 3,000-foot altitude.

Carnegie-Illinois claims that the porcelain-enamel will not chip, discolor or be affected by temperature variation or sunlight.

DOUGLAS EQUIPPED AIRLINES: Alaska Airlines, All American Aviation, American Airlines, American Export Airlines, Braniff Airways, Chicago & Southern Air Lines, Colonial Airlines, Continental Air Lines, Delta Air Lines, Eastern Air Lines, Hawaiian Airlines, Island Air Lines, Mid-Continent Airlines, National Airlines, Northeast Airlines, Northwest Airlines, Pan American Airways, Panagra (Pan American-Grace Airways), Peck & Rice Airways, Pennsylvania-Central Airlines, Transcontinental & Western Air, United Air Lines, Western Air Lines, Plus 32 Foreign Airlines.

You'll have it soon

that plane you gave up for VICTORY

Cruising in excess of three hundred miles per hour along the routes of the leading airlines, the dependable DC-6 will be ready soon to take you anywhere over land or sea, with comfort, speed, economy and assurance beyond anything you have ever imagined.

GREATEST NAME IN AVIATION

DOUGLAS DC-6

Sister Ship of the Famous C-54 Combat Air Transport

ports and liaison planes, are offered for sale at the RFC storage centers at fixed prices or under competitive bids. Comparative sales prices on Cessna UC-78's range from $3,900 to $8,500 depending upon the type. Beech UC-45's are sold on competitive sealed bids. Primary trainers have been disposed of at prices ranging from $875 to $2,400, with the average about $1,100. Other prices: Lockheed *Lodestars* C-60, $40,000 and C-56 cargo *Lodestars* are $28,000.

RFC lays down three sales conditions: (1) the planes are sold "as is, where is"; (2) their use is subject to CAA license; (3) competitive bids are subject to OPA price ceilings. Airlines, dealers, veterans and individuals are listed among the buyers.

Little over a month after VE-Day the SPB moved to cope with the anticipated huge influx of surplus combat aircraft by issuing Special Order No. 11 which directed that all commercially unsalable surplus planes and related parts and equipment, other than those required for educational uses, research, and for a few special purposes, be salvaged and scrapped. All flyable airplanes, determined by RFC to be commercially unsalable, will be flown by the Army and Navy on a "last flight" to RFC storage fields for salvage and scrapping, but those in non-flyable condition will be salvaged and scrapped by the services on instruction of RFC.

SPB also created a special committee to study all aspects of aircraft salvage and scrap. The committee will consult with the National Academy of Sciences and the Battelle Memorial Institute, which was selected by the academy to study the metallurgical aspects of aircraft scrap, and with an industry advisory committee composed of representatives of the aluminum production, fabrication, foundry and smelting industries.

Surplus property officials estimate that from 1,500,000,000 to 3,000,000,000 pounds of aluminum have gone into airplane production during the war and they believe that one-third, or a billion pounds, can be salvaged from surplus Army and Navy planes. With new production of the metal expanded during the war to nearly two billion pounds annually, and the salvaging of an additional billion pounds expected from war-weary or obsolete planes, the nation will have an aluminum supply far beyond its normal pre-war needs. In 1940 the United States produced only 412,000,000 pounds of aluminum. SPB believes, however, that a secondary metal can be produced from surplus planes at a price sufficiently lower than alloys of virgin metal to encourage almost limitless applications—prefabricated housing, kitchenware, roofing, fencing and many household articles requiring a light-weight metal.

In addition to salvage and scrap, another major outlet for surplus combat aircraft exists in the 30,000 schools and colleges in the United States. SPB's Regulation No. 4, issued at the time of Germany's surrender, will make it possible for several million young people, returned veterans and adult learners to acquire a knowledge of aviation firsthand from planes and equipment produced for World War II. (See "Air Force for Sale," FLYING, June, 1945.)

Disposal of surplus planes overseas has moved slowly, although a recent reorganization should speed action. The Foreign Economic Administration formerly acted as the disposal agency for surplus aircraft in foreign territory and returned lend-lease aircraft, but was unable to hire sufficient personnel.

The latter obstacle was removed by transferring the task to an Army-Navy Liquidation Commission which will have the advantage of knowing where the surplus planes are and also of being able to call on service personnel to dispose of them under the broad supervision of the SPB. Some of the FEA personnel is expected to join the Commission.

Fighters are expected to be the principal surplus overseas, along with artillery spotters and other war-weary planes which can't cross the ocean. *Fortresses*, *Liberators* and transports are being flown back to the United States with full passenger lists of veterans. Prior to VE-Day foreign aircraft disposal was limited largely to a few hundred planes declared surplus domestically. FEA sold 89 primary trainers to Chile and allocated a number of transports to foreign countries recently, including three to Denmark and seven to Australia.

Some conception of the size of the surplus disposal job can be gained from the fact that from July, 1940, to December, 1945, approximately 338,000 military planes of all types will have been produced by the United States. Included in this total will be more than 80,000 bombers and an equal number of fighters, more than 20,000 transports and nearly 60,000 trainers. A greater percentage of the latter two types may have civilian flight purposes but there still will be unwanted military transports when the airlines start receiving deliveries on their post-war orders of big, new planes.

The cargo and transport surplus plane group comprises *Skytroopers*, *Lodestars*. Among the bombers are *Forts*, *Liberators*, *Mitchells* and *Marauders*. Also on the surplus list are *Havocs*, *Buccaneers*, *Dauntlesses*, *Warhawks*, *Lancers*, *Airacobras* and P-36's. Some estimates of the potential surplus in C-47's and other converted DC-3 type planes run as high as 8,000.

Yet fewer than 360 passenger and cargo planes were needed to fill the commercial transport lines' needs in the United States before the war and probably not more than 600 planes served the airlines of the rest of the world. The most optimistic aviation leaders doubt that this surplus can be used up in post-war civilian transport.

One of the most promising ideas for disposing of surplus combat aircraft is to "cannibalize" such planes—tear them down for the valuable component parts and metal which they contain. For example, the flooded areas of Holland may be pumped dry by the powerful engines of a *Fortress*. A citrus grower in Florida

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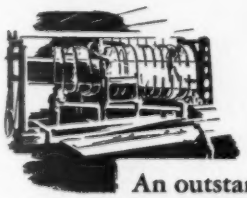

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MANUFACTURERS OF COMPLETE AIRCRAFT ASSEMBLIES

may combat frost by circulating warm currents of air through his orange grove with the aid of the horsepower churned up by a *Thunderbolt* fighter. The engines from a war-weary *Liberator* may provide stand-by power for a utility plant in Arkansas.

The National Academy of Sciences has broken the problem down into four sections—powerplants; auxiliary engines, including the 72 electric motors on the largest bombers; electrical systems, radio equipment and lights; metallurgical. Each of these various categories has been "farmed out" for intensive study to other research experts.

The American Society of Mechanical Engineers drew the research job on engines while the problem of what to do with motors and electrical systems was turned over to the Society of Electrical Engineers. The experts are not too hopeful of finding abundant peacetime uses for the scores of electric motors which go into a modern bombing plane because they are 24-volt mechanisms and few consumers have the proper electrical power available.

Surplus officials believe there may be something like 100,000 new airplane engines on hand when the war assembly lines are shut down. The Aircraft Industries Association has proposed that an adequate stockpile of surplus engines and other components be maintained as a safeguard against future emergencies, with a specific portion of the stockpile to be replaced at regular intervals with advanced models. However, SPB is pressing the development of possible post-war non-flight uses for plane engines under the guidance of George Shapiro and his colleagues in the engineering and research unit of the Aviation Division's components section.

Among the possibilities being explored are the use of surplus plane engines in generating electric power; in farm pumping operations, and in marine applications. The U. S. Cotton Ginning Laboratory, a division of the Department of Agriculture, also has requested several surplus plane engines for experiments in providing power for cotton ginning processes.

Some experts figure that the use of airplane engines in electric power generation will be approximately one-third more expensive than the operation of Diesels. However, they point out numerous compensating factors. It is thought that a complete generating unit built around a 1,000-horsepower plant engine can be sold for $3,000 or $4,000 against many times that cost for a Diesel. In addition, experts contend that there will be tremendous savings on maintenance and installation, with the airplane engine occupying far less space than a Diesel. Current experiments envision the use of producer gas or some other substitute, instead of high-octane aviation fuel, with consequent additional savings. Regardless, they would certainly have stand-by uses.

Westinghouse built the first demonstrating unit—an electrical generator constructed around an aircraft engine designed to turn out 100 kilowatts of power—and experiments now are being conducted with it. Some smaller plane engines also are in use as generators to start *Superfortresses*. Surplus property officials reported that 12,000 to 15,000 plane engines had been declared surplus by mid-June. They believe that numerous post-war uses can be found for them and a big market tapped in foreign countries too poor industrially to afford other power plants. Sale of the engines abroad would avoid upsetting the domestic market.

The Army Air Forces is co-operating with SPB in trying to work out the problem of disposing of surplus combat aircraft. At Patterson Field, O., the AAF undertook the experimental disassembly of a war-weary *Liberator* to help determine whether the cost of disassembly outweighs residual value.

Leading salvage experts in the automotive industry were invited to examine each part.

Industry representatives who viewed an exhibit of parts were pessimistic about the economic feasibility of breaking planes up for sale in a non-aviation market but they were optimistic about the sales possibilities of such items as compasses, clocks, fire extinguishers and thermos bottles. Oxygen tanks might be used for acetylene containers; radio equipment from planes could be adapted for two-way communications on passenger and freight trains or could be sold to returning radio operators and technicians for amateur experimental work. Pilots' seats might be used by bus drivers; hydraulic landing gear might be used on dump trucks; self-sealing gasoline tanks might be utilized as fuel tanks on motor boats.

But the demand arising from these uses only scratches the surface of the supply, SPB believes. It is not expected that the sale of components can be counted as a major means of reducing the quantities of left-over aircraft. The unsaleable balance, whether of planes or parts, SPB recommends, should be accepted realistically for what it is—part of the cost of war. SPB is, nevertheless, determined to save from the scrap heap any property which will have economic usefulness. The myriad instruments in a complicated fighter, for example, are much too costly for ordinary private use. But if such instruments, collected from surplus aircraft, are offered for sale at low prices to private flyers after the war, a demand may be created that will develop into an appreciable market.

Battelle Memorial Institute, of Colum-

LAND CATAPULT

THESE Eastern Aircraft FM-2 *(Wildcat)* Navy planes engaging in dry-land catapult maneuvers, employ a novel device which gives pilots assigned to the Carrier Qualification Unit at the Glenview, Ill., Naval Air Station, training in the procedures used aboard a carrier.

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Designated by the Navy as HE-1 field catapult and arresting gear, the sling-shot cable device propels a heavy fighter plane from a stand-still to an airborne attitude in a very short distance. Lines painted on the catapult platform to aid in keeping the pilot centered are identical with those painted on a carrier deck.

In the photo showing the plane just as it leaves the ground, the main catapult cable is at the left in the center of the deck while the cable loop attachment which is affixed to the catapult between the plane's wheels has just dropped down beneath them. The catapult is a long cable, angling off to both sides of the platform. Part of the cable trough may be seen in the right foreground, while the whirling anemometer cups to the left provide constant wind velocity readings.

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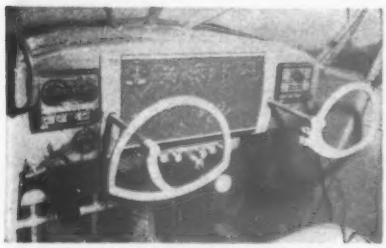

Typical installation of RANGER model 108-B receiver and model 206, 10.5 watt transmitter. Receiver has 3105 kc spot besides 195-410 kc band, plugs for two sets of headphones and an inter-phone circuit. Transmitter operates from 6 or 12 volt ship's battery through RANGER designed vibrator power supply.

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bus, O., was handed the key assignment of devising the best method to reduce a plane to the best size components. A wing, for example, contains steel, copper, aluminum and endless wiring. To take it apart scientifically would be too costly, so the solution may be simply to yank it apart in big chunks and salvage the metal.

Numerous methods have been devised to salvage the metals in a plane's structure. The fuselage can be cut into manageable sizes with huge metal saws, the pieces put into a furnace and the aluminum drawn off at a low temperature and shaped into ingots. The Aluminum Corporation of America has an enormous vat in which a whole plane can be dunked in a caustic soda bath—the engines, landing gear and other accessories first having been removed. The chemicals eat away the aluminum and almost pure powdered alumina is obtained. The advantage of this process is that it avoids tedious disassembly operations. The drawback is that it requires considerable time and, if there were 50,000 excess military planes waiting to be salvaged, the time element would loom very large.

Extensive tests are being made of both the furnace method and the chemical process for converting aircraft scrap to aluminum ingots. The research work is under the over-all direction of Dr. William F. Durand, of the National Academy of Sciences. Indications are, he said, that the aluminum plane carcass—stripped to a reasonable degree of contaminating metals such as iron, steel, copper, zinc, etc.—can be transformed by the heat method into ingots susceptible to being drawn into plates or shapes at a price which will make possible its general use by industry.

Dr. Durand also heads up the research on adaptation of aeronautical engines into stationary power plants. There is no question that such adaptation is possible, he explained. Current studies are aimed at the engineering and economic feasibility of such conversion. Among the practical problems being considered are the development of fans for cooling the engines; provision of a suitable bed-plate or foundation and adapting the engine to a lower grade fuel. END

The VIP Express

(*Continued from page 27*)

Gilbert Mason, chief interior design engineer of the Douglas plant at Santa Monica, Calif., where it was built.

With Lieut. Col. Henry T. Myers in command, the plane has flown into or over 44 countries for a total of more than 154,000 miles, or about 700 hours. The crew claims to have broken six world flight records.

Colonel Myers took delivery of the plane at Santa Monica and flew it back to Washington. Its first mission outside the United States was to fly Secretary of War Stimson to Europe shortly after the invasion.

"The Secretary said he was in a hurry," Myers related, "so we flew from Washington to Naples, a distance of 4,200 miles, in 24 hours. We then flew from Naples to London. Coming back we were in a hurry again and flew non-stop from London to Washington—3,800 miles in 17 hr., 50 min."

The "Flying White House" was assigned to carry certain members of President Roosevelt's party when he made his inspection of the Pacific and Alaska a short time later.

"We flew direct from Los Angeles to Honolulu, 2,565 miles, in 10 hr. 40 min. and then, when the President left Honolulu and started for Alaska, we took off from Honolulu and flew direct to Kodiak," the colonel said." The flight from Hono-

"The monotony of this New York-London-Bagdad-Bombay run is driving me crazy!"

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All of the above types formerly were used by the Army and Navy in their respective pilot training programs.

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Wickenburg, Arizona	Echeverria
Pine Bluff, Arkansas	Grider
West Helena, Arkansas	Thompson-Robbins
Blythe, California	Gary
Concord, California	Sherman
Fresno, California	Chandler Field
Hemet, California	Ryan
Ontario, California	Cal-Aero
Denver, Colorado	Rutledge
Miami, Florida	Chapman
St. Petersburg, Florida	Ludwig-Sky Harbor
Americus, Georgia	Souther
Augusta, Georgia	Bush
Douglas, Georgia	Municipal
Lansing, Illinois	Ford-Lansing
Indianapolis, Indiana	Sky Harbor
Davenport, Iowa	Cran
Wichita, Kansas	Municipal
Baton Rouge, Louisiana	E. Baton Rouge Parish
North Grafton, Massachusetts	North Grafton
Lansing, Michigan	Capitol City
Minneapolis, Minnesota	Victory
Clarksdale, Mississippi	Fletcher
Madison, Mississippi	Augustine
Cape Girardeau, Missouri	Harris
Kansas City, Missouri	Municipal
Robertson, Missouri	Municipal
Sikeston, Missouri	Harvey Park
Helena, Montana	Municipal
Omaha, Nebraska	Municipal
Reno, Nevada	Reno
Readington, New Jersey	Solberg-Hunterton
Albuquerque, New Mexico	Army Air Field
Albany, New York	Albany
Rochester, New York	Municipal
White Plains, New York	Westchester County
Charlotte, North Carolina	Carson
Akron, Ohio	Municipal
Cincinnati, Ohio	Lunkin
Muskogee, Oklahoma	Hat Box
Oklahoma City, Oklahoma	Cimarron
Ponca City, Oklahoma	Municipal
Portland, Oregon	Portland-Troutdale
Pittsburgh, Pennsylvania	Bettis
Bennettsville, South Carolina	Palmer
Camden, South Carolina	Woodward
Sioux Falls, South Dakota	Sioux
Jackson, Tennessee	McKellar
Union City, Tennessee	Embry-Riddle
Ballinger, Texas	Bruce
Corsicana, Texas	Corsicana
Cuero, Texas	Municipal
Fort Stockton, Texas	Gibbs
Fort Worth, Texas	Hicks
Houston, Texas	Municipal
Lamesa, Texas	Lamesa
San Antonio, Texas	Municipal
Stamford, Texas	Arledge
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Morgantown, West Virginia	Municipal

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14—2

lulu to Alaska had never been made before but we flew the 2,700 miles in 12 hours.

"Coming down from Kodiak to Seattle we made awfully good speed and beat another plane that later claimed a record but I didn't keep track of the time.

"We went back to Washington for awhile and then were dispatched to Rio de Janeiro to pick up Mme. Chiang Kai-Shek. She said she wanted to get to Washington in a hurry so we flew the 5,300 miles back with only two stops and made it in 22 hr. 55 min., the first and last time an airplane has flown more than 5,000 miles in one day."

During the Quebec conference, Colonel Myers and his crew were kept busy running a shuttle service for dignitaries between Washington and Quebec. Afterwards the plane carried General Marshall and Byrnes to Paris.

"We made one stop, in Newfoundland," Myers recalls. "It didn't seem to me that we were flying particularly fast but we made the 3,600-mile run in 18 hours.

"We had quite an experience in Paris. Nobody had flown in or out of Paris at night since the war but General Marshall told me he wanted to take off that night so that he could get back in Washington the next afternoon in time to get some work done at his office. Some of us spent a few hours in Paris and then tried to get back to the field in time for the 11 p.m. take-off. A French driver got us lost but we still made the field a few minutes before the general arrived.

"General Marshall had a courier meet him in Newfoundland with the latest war reports so he could get five hours work done on the way to Washington. He worked all the way to Washington and we got him there in time to get a few hours more work done that afternoon.

"In Washington was another party waiting to go to Paris—the joint committee for the reorganization of the Army and Navy, comprising three admirals and three generals, headed by Admiral Richardson and General George.

"We parked the airplane in Paris and stayed around while the committee talked with the various generals. One day they decided to take a trip up to the front near Brussels and I went along. We had an enlisted man driving who claimed to know the way. We came to a fork in the road and turned the wrong way, mistakenly. We kept seeing fewer and fewer people and when you see fewer and fewer people at the front you know you are in the wrong spot. I asked the driver if he was sure he knew where he as going. Then we started hearing guns and soon we passed a sign on the road that said 'Metz.' We were at least three miles behind the German lines with a car full of generals and admirals! We got out of there in a hurry!

"After the committee had finished its work in Paris I flew it back to Washington. In a few days we took off with it for a tour of the Pacific war areas.

"We flew all over the Pacific—Honolulu to Kwajelein, Saipan, Guam, Peleliu, Leyte and back—a total of 25,000 miles. We didn't break any records on this trip, flew about 10 hours a day and always arrived at our destination before dark.

"We landed at Leyte at the time General MacArthur's men had only one airstrip—the one at Tacloban. There was only one airfield and the whole Far Eastern Air Forces was trying to operate off of it.

"I landed and the tower told me if I didn't get that airplane off the field in 15 minutes they would shove it into the ocean!

"The operations officer told me: 'The field will only hold 200 airplanes and we have 230 on it now and 15 more coming in.' I said, 'O.K. Give me some gas and I'll take off—I don't like it here anyway.' I gassed and pulled up at the end of the runway for a take-off. Just then they had a red alert and the pursuits started to scramble. A bunch of P-38's started taking off from one end of the field. At the same time a bunch of Troop Carrier *Skytrains* were coming in for landing at the other end. The P-38's were slamming down from one end of the runway and the *Skytrains* were landing on the other. The pursuits would head right for the transports and then zoom over them, missing them by inches. It was a hectic few minutes.

"I couldn't get off the runway. The pursuits would take off right over us and the transports come heading for us from the other direction. I could not decide whether to tell my passengers to jump and run for safety or to stay with the plane. I finally spotted a place to park and ran the plane off the runway. They

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told me again to get it out of there or they'd dunk it. I tried to explain that we had a lot of generals and admirals aboard to see General MacArthur but they said they didn't give a damn—they were fighting a war.

"I finally got the thing straightened out, after the alert was over. We stayed a day and a half and then headed back.

"We were back in Washington just before Christmas and were not out of the states again until late in January, although there were a lot of trips over the country."

Then came the Yalta conference.

"We were assigned to take President Roosevelt to Yalta and left the states two days ahead to plan the flight.

"Heretofore, anybody who flew into Russia had gone by Teheran or across Siberia by way of Alaska. We didn't see any sense in going the long way around so we laid out a course around the southern tip of Greece and then into the Aegean and Bosporus and direct to Saki, the airfield near Yalta. This was a brand new route and they were not going to allow the President to fly it unless someone had pioneered it. So we went ahead and flew a dry run to see if anyone would shoot at us and if the field was big enough for a *Skymaster*. Then we flew back to pick up the President.

"When we arrived at the field where the President was to come aboard we found another *Skymaster*—the plane that had been delivered to Churchill in 1944 and was used on all his trips.

"Just before we started to Saki I got together with the pilot of Churchill's plane and decided on our flight routine. Churchill and Mr. Roosevelt were to take off at about the same time and we wanted to land at about the same time. The British pilot and I agreed on our course and speed. I took off with Mr. Roosevelt five minutes ahead of Churchill's plane. But the *Flying White House* seems to be faster than most C-54's and we beat Churchill's plane in to Saki by 20 minutes.

"While we were at Saki both Mr. Churchill and Molotov, as well as other officials, came aboard to inspect the airplane.

"After Mr. Roosevelt and Churchill left Saki in automobiles for Yalta, 60 miles away, we flew down to Cairo and back—another dry run to familiarize ourselves with the route the President was to take following the conference. The airplane was in good shape and performed perfectly. The day before the President was to come aboard to fly to Cairo I took the plane up for a test hop. During the flight the tower called me and told me there was smoke coming from the No. 2 engine. We landed and found there was a broken connecting rod. We found another *Sky-*

FLYING

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master and stole an engine off of it. My ground crew worked all night changing it.

"We took the President to Cairo and Churchill came down too, with the other party trailing. When the President boarded the cruiser we came on home."

Regarding records, Colonel Myers said:

"Whether you set a record depends upon the passengers. If they want to stop at every crossroad along the route, then you stop. But if someone tells me he wants to get from here to Russia in a hurry, then we can set a record. The *Skymasters* are faster than any other heavy airplane we now have in service, with the exception of the B-29.

"We haven't had this plane long enough to show what it really will do. We have had only one of the engines changed; this month we had our first tire change."

Colonel Myers has been lucky with weather on his ocean-hopping cruises. He never knows from one day to the next in what part of the world he will be.

"I bought a clock in Cairo on one trip," he relates, "and after getting it home the doggone thing wouldn't run. Three weeks later I returned and exchanged it.

"Going through Fiji one time I ordered a bracelet and paid for it. The shopkeeper was supposed to ship it to me but didn't. I guess he figured he'd never see me again. But we went back that way in a month or two and I got the bracelet."

The colonel usually carries a camera that takes 35 photos on a roll.

"By the time I get around to snapping 35 shots there are pictures on the roll from all over the world," he says. "I have a devil of a time figuring where they all came from."

One time, flying back to the states on an eastward round-the-world flight, Colonel Myers landed at Fiji.

"I looked over and saw a familiar C-54 on the field. It was Fred Kelly II, flying General Somervell. He was headed down to the Southwest Pacific and around the world in the opposite direction to which I was flying.

"I flew on in to Washington and then hopped off for Cairo. Landing at the field I saw that same C-54 again. Sure enough it was Fred Kelly II. He had come into Cairo the other way, still on the 'rounder.' We parted company there. He flew on up to England and I went to Russia and Siberia and came back.

"Just as I landed at Washington, in comes Kelly, not five minutes behind me. We had been around the world in opposite directions and landed five minutes apart!" END

Three Keys to Air Power

(*Continued from page 29*)

classes as a part of their curriculum. Aviation education is education for peace.

Underlying all these component parts of air power and constituting the broad, basic foundation on which air power rests is *aircraft industry*, the backbone of air power. Our air future is inextricably tied up with the future of our aircraft manufacturing industry and the maintenance and strengthening of this essential element of air power is our greatest immediate responsibility.

The problems of this industry immediately following V-J Day are manifold and serious in the extreme. Existing legislation indicates no awareness of these problems. Section 202 of the War Mobilization and Reconversion Act states: "Any contracting agency shall terminate prime contracts for war production whenever in the opinion of the agency the performance of such contracts will not be needed for the prosecution of the war." Such action bids fair to generate a genuine crisis in our national air strength.

An indication of the gravity of the situation is the issuance of a special interim report by the Advisory Committee on the Aircraft Industry of the National Planning Association far in advance of the scheduled presentation of the complete report. Headed by Dr. Edward P. Warner, vice-chairman of the Civil Aeronautics Board, the committee believes: "It is essential that this nation plan promptly to put into operation immediately after V-J Day whatever program of post-war military procurement is estimated to be necessary for world security and national defense and to provide through legislation and executive action for carrying out such a program. Without a well-defined national policy for this transition period, the aircraft manufacturing industry cannot play its part effectively in providing aircraft for military and civil use."

The Advisory Committee recognizes the importance of the preservation of the aircraft manufacturing industry as a whole and firmly believes that if the aggregate of skills possessed by the industry is dissipated by complete stoppage of production, the technological loss may be irrecoverable, especially in view of the rapid tempo of technical progress.

Cancellation of all contracts will mean the disintegration of the vital research, engineering, labor and management teams that have been so painstakingly assembled, trained and integrated into a smooth working machine during this war. Here is the very backbone of our air power and here is the essential nucleus that must be preserved if national and world peace is to be guaranteed. Long term policies may require long deliberations and the industry is reconciled to this delay.

We have had a long range program throughout the war; we will have a long range program in the future. What is vitally needed is an immediate transition program which alone can preserve the existing research and technological skills.

Obviously, the American aircraft manufacturing industry, the world's greatest, faces great danger in the months following V-J Day unless action is taken now.

Fly Your FUNK B-75-L

Because it's a powerful plane, designed for speed as well as safety, you can count on your Funk plane to save you time as well as money. The Funk plane, powered by the famous Lycoming 75 H.P. motor, means dependability. It means faster travel, quicker business trips and longer vacations because you save time getting there. For Safety, Speed and Economy, fly a Funk plane! Descriptive circular on request.

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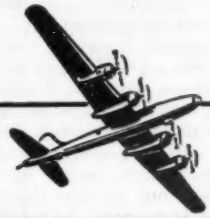
BRIGGS PREPARES FOR PEACETIME MANUFACTURING



$626,000,000 IN WAR BUSINESS

From 1941 through May 31, 1945

51.7% FOR WAGES $323,640,000	2.16% FOR DIVIDENDS $13,520,000
34.32% TO SUPPLIERS $214,850,000	1.34% FOR DEPRECIATION $8,390,000
8.89% FOR TAXES $55,650,000	.88% FOR RECONVERSION $5,500,000

.71% LEFT IN BUSINESS $4,450,000

Briggs has just completed $626,000,000 worth of war business—1941 through May 31, 1945—consisting principally of large aircraft assemblies, heavy bomber turrets and heavy and medium tank hulls. Its employment rose from 23,000 to 36,565 in the same period, and it added almost a million square feet of floor space to its manufacturing operations. Still on its books and in production are many more war orders.

Changes in War Requirements Free Space for Peacetime Work

Now, however, due to changes in war requirements, facilities devoted to war work have been decreased about 20%, thus permitting the Company to continue to be able to meet its war contracts, and at the same time to begin to prepare for peacetime body manufacturing.

New Foundry Established In Cleveland

The reduction in war work also permits Briggs to make postwar plans in other fields. For some time the Company has been experimenting with plaster molds. Beginning with April of last year, it put into operation on war work a large new foundry in Cleveland, Ohio, using plaster molds exclusively and licensed under what is known as the "Capaco Castings Process." This will soon be available for making intricate and fine castings for peacetime manufacturing.

Plans Laid for Postwar Plumbing Ware Market

Briggs is also planning to re-enter the plumbing ware market on a large scale. On September 30, 1944 the John Douglas Company of Cincinnati, Ohio, was purchased—one of the country's oldest independent manufacturers of plumbing ware and plumbing fixtures. In securing this Company, Briggs has added enough plumbing ware facilities to what it already has so that it will be able, in the postwar market, to offer a complete line of plumbing ware for practically all purposes.

1944 Profits After Taxes Were $5,307,161.10

Briggs' profits after taxes in 1944 and after provision for renegotiation of war contracts, costs of plant reconversion, and other costs arising from the war, were $5,307,161.10, as compared with $5,239,350.74 in 1943.

The consolidated financial position of the Company and its domestic subsidiaries on December 31, 1944 showed current assets of $82,647,409.64 and current liabilities of $54,303,994.08, as compared with current assets of $99,657,442.40 and current liabilities of $73,985,660.70 in 1943.

The Company paid a $2.00 dividend per share of stock in 1944, the same as in 1942 and 1943.

To Spend $10,000,000 On Reconversion

Briggs' future plans call for the expenditure of approximately $10,000,000 for reconversion, re-equipping and new machinery. However, the Company believes that its principal job must continue to be production for war until final victory has been achieved in the Pacific. Until that time, the needs of the Armed Forces will always come first.

BRIGGS MANUFACTURING COMPANY — DETROIT 14, MICHIGAN

IN WARTIME:

BODIES FOR BOMBERS, FIGHTERS, TANKS AND AMBULANCES, AND BOMBER TURRETS.

IN PEACETIME:

BODIES FOR PASSENGER CARS AND TRUCKS, PLUMBING WARE, AND NON-FERROUS CASTINGS.

That these are not foolish fears or propaganda fancies is borne out by examining some startlingly convincing history after the last war. Here are some of the companies that produced American military planes and engines during World War I: Standard, Aeromarine, L.W.F., Burgess, Curtiss, Thomas-Morse.

Recognize them? Have you seen a Burgess fighter recently? Was there a Standard dive bomber over your house lately? Assuredly not and the reason is simple: All of the aircraft manufacturers of World War I either disappeared completely after the Armistice or went through complete reorganization and recapitalization during the years preceding World War II.

The current assets of the aircraft manufacturing industry are so small that a loss of only 5 per cent in the process of contract termination, inventory disposal and reconversion would completely eliminate all working capital. A loss of only eight per cent of sales could completely wipe out all privately invested capital in the industry.

This imminent danger cannot be tempered by arguments that production of commercial airplanes will "tide over" the industry for nothing could be further from the truth. William A. M. Burden, Assistant Secretary of Commerce, estimates that post-war annual sales of the aircraft manufacturing industry will amount to $1,270,000,000. Compared with the $16,444,000,000 sales of 1944, this figure is fractional and indicates the tremendous "shrinkage" in store for the industry. But the amazing fact about this post-war estimate is that only $270,000,000 of it is for commercial aircraft. The remaining one billion dollars is for military aircraft and is completely contingent upon Army and Navy procurement contracts.

It must be clear, however, that the industry does not ask and would not accept military business simply as a subsidy for its survival. As a tremendous dynamic force in our national economy and security, the industry is prepared to shoulder its full responsibility as an instrument through which our welfare can be safeguarded and is prepared to achieve that goal as a competitive, private enterprise under our democratic system of government.

The prompt and wise disposal of surplus aviation supplies is vital to the preservation of our manufacturing industry and to the growth of the nation's air power. Government disposal policies must be executed on the basis of their long range effect on the national economy, industrial employment and future strength in the air and not merely in terms of realizing the largest possible immediate return on the investment.

The insidious danger of "holding on" to surplus aviation equipment could not be better illustrated than by a glance at American liquid-cooled engine development after World War I. While European nations continued to press their development of the type, this nation was glutted with *Liberty* engines which were available in such quantities and for such low prices that engine manufacturers could not profit by the development of a new design.

Liberty engines were stocked by the Army until 1930, 12 years after the Armistice. This 12-year delay placed America far behind in the development race before this war.

DeHavilland 4's and 9's, our principal production airplanes of the last war, were used by the Army as well as the Forest Fire Patrol and the Post Office Department through the late 20's, while the development of fast, long-range reconnaissance designs lagged.

The impedimentation of technological progress is not the only danger of "holding on" to surplus equipment. The removal, crating, shipping, disassembly, preparation for storage and storage of aeronautical equipment is an enormously expensive procedure and the costs of these operations augmented by the costs of long-term storage and insurance would quickly consume the net worth of the items.

Surplus facilities, like aircraft, must be disposed of in terms of their use towards fullest employment and maintenance of our air power. Idle facilities are a costly waste. It will be far more beneficial to the nation to lease a facility to the industry at a cost of $1 a year and thereby permit its use in the manufacture of aircraft than to let it stand idle with a million-dollar price tag on it. The industry, in the absence of detailed information on the size and type of post-war business, cannot intelligently make arrangements for the absorption of Government-owned plants and equipment. Leniency in the granting of long-term options should be exercised by the Government so that the industry will have time to study future plans before making definite commitments.

General Arnold has said: "The first essential of the air power necessary for our national security is preeminence in research."

Whereas the work of Government research laboratories is largely investigating basic theories and fundamental knowledge, the application of the results of this basic research is the responsibility of the industry's extensive research and development staffs. Government research laboratories are not intended to produce designs of airplanes, new power plants or new methods of construction. They are designed to produce only fundamental facts which serve as the starting point for industry's own program of research and development.

The industry has spent nearly $100,000,000 on the construction of wind tunnels, structural test and research laboratories through which their responsibility for de-

STORM AND A FLAT-TOP

HERE is what a Navy flat-top looks like wallowing through heavy seas in a tropical typhoon. "Palisades," or barriers, are erected on the deck to break up the strong flow of air over the carrier surface so that strong, concentrated gusts will not damage the *Hellcats* parked there. Openings at intervals across the deck permit barriers to be set up at any desired point.

The pitch and roll of the big ship during such a storm is often so violent that it exceeds 27½° from the horizon, as shown at the right.

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tail design and construction can be implemented. It has organized, trained and perfected a team of 11,000 research, design and development engineers that has given America its preponderance of superior military airplanes. It is vital that an essential nucleus of these skilled research, development and production engineers be preserved by the industry. Only a continuing program of Government procurement can protect our technological investment in aviation progress.

This war has displayed to the world the miracle of aircraft production of which our industry is capable. Since 1940 we have produced nearly 300,000 military airplanes—more than all the nations of the world in all history. The creation of this vast air fleet was more than simply a question of manpower.

How has it been done? By the creation of a trained team of design and production engineers which provided the "know-how." It seems to be a failing of most Americans to think of aircraft manufacturing in terms of long production lines with women in overalls operating rivet guns. The first production airplane is a full year away from the first experimental airplane. The design, proving and development of production jigs, dies, forms and tools represents the greatest single investment in time and engineering man-hours in the introduction into production of a new model. Following the completion of tooling for a new model, the job of production is simply a question of time and manpower.

However, production is the development stage of a new model. The design of new models based on new research findings and the fabrication of an experimental model alone does not constitute air power progress. The completion of a service test quantity of airplanes alone does not constitute the development of a design.

The development process must include quantity production, for only through this process can tooling be developed, production techniques perfected, service-originated changes incorporated and design modifications tested and utilized. One super-bomber over Berlin might have destroyed a city block but it was 1,000-plane raids that destroyed entire cities, 5,000-plane raids that broke the back of the German war potential and 10,000-plane raids that brought the Wehrmacht to its knees.

The aeronautical and allied scientific developments of this war period are little more than a pointing finger toward the miracles waiting to be explored. The development of reaction propulsion has created an entirely new and, so far as is presently known, limitless field for research and development. Electronics and radio flight control equipment have created an entirely new field of research. Long-distance flying has earned its long pants during this war and has created new avenues of development of aircraft specially designed for the purpose. Metals never before used for aircraft structural parts have been developed during this war to the point where three experimental types have been fabricated wholly of a formerly rare and unproved element. All these channels of research must be explored to their fullest potentialities if we are to remain abreast in the international race.

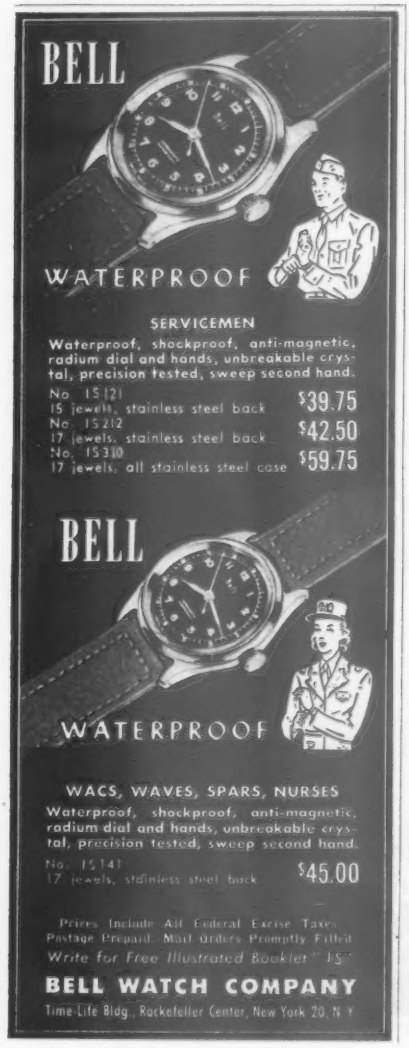
As aircraft engineering progresses the job becomes increasingly complex. Whereas the design and engineering of our standard heavy bomber of 1939 required 150,000 man-hours to bring past the prototype stage, our present long-range bomber, now smashing Tokyo, took 1,500,000 man-hours to create in experimental form. This is a graphic indication of the cumulative nature of aeronautical problems and leads to the logical assumption that our next successive bomber design will require 15 million man-hours of engineering research and development to create its prototype.

And yet this is only the down-payment on air power. Only 20 per cent of the total cost of production of a new type is expended on the design, construction and test of the first experimental model. The remaining 80 per cent, four times as much, is expended in the development of the design to a satisfactory tactical type. This indicates the necessity for quantity production as an essential element in the development of aerial strength.

It is imperative that prompt legislative action be taken to insure a continuation of current research, development and production projects and that this interim action be followed as rapidly as possible by the implementation of a long-range warplane procurement program looking towards the maintenance of this nation's position of preeminence in the air.

We must see to it that every man, woman and child in America becomes conscious of our responsibility for the preservation and strengthening of that industry which can help provide us and our neighbor nations in the World Organization with the security so vital to the preservation of permanent peace and our free way of life.

We can all have serious doubts that the world can survive another war, for terrible as this one has been the next bids fair to destroy civilization utterly. Air power provides us with an instrument to prevent that destruction for our air power will be our peace power. With all our hopes and our dreams and our very existence inextricably bound with our strength in the air, certainly air power is a national responsibility. END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Decision in Air Policy

(*Continued from page 25*)

taining the maximum development of its foreign air transportation system.

"No effective substitute for healthy competition as a stimulus to progress and efficiency can be found in monopoly. The stimulus to an imaginative management that results from competitive efforts of business rivals to secure patronage and trade cannot be matched as a motivating force for the public welfare even by the private profit incentive. The latter might be satisfied with moderate traffic at high rates, while public welfare would require mass transportation at lower fares and charges.

"The improvements which flow from a competitive service cannot be decreed by administrative fiat. The presence of more than one United States company in the European area should provide a broader and more intensive development of equipment, facilities, and services than would be achieved by one company."

Another pattern-setting phase of the Board's decision dealt with the separation between operations of international air carriers and domestic air carriers. That separation has existed down through the years, partly because of Governmental policy and partly because commercial intercontinental air travel (conducted almost entirely by flying boats) has historically terminated at shore line ports of entry.

Despite the argument that Pan American would be at a serious disadvantage in competing for transocean traffic against American international lines also having domestic routes, the Board decreed that domestic carriers could engage in inter-

national air transportation. Agreeing that such a move would have some adverse competitive effect upon an international air carrier, such as Pan American, whose operations are limited to ports of entry, the Board authorized Pan American to establish a domestic route to feed its over-ocean facilities.

After it decided that question, the Board designated Chicago, Detroit, Boston, New York, Philadelphia and Washington as co-terminals for international services of American Export, TWA and Pan American. Pan American's request for designation of Montreal as an intermediate point in lieu of its present base at Shediac, New Brunswick, was denied.

In its discussion of the Pan American position that the "unsettled state of world affairs makes it impracticable to reach a sound conclusion respecting an international air route pattern in the North Atlantic area," the Board said:

"In support of this contention (by Pan Am) it has referred to the absence of agreements with respect to landing rights and the possibility evinced in the course of the Chicago (Civil Aviation) conference that air transportation rights in foreign countires may be subject to various conditions.

"Although this consideration is of some importance in fixing the term of the certificates (seven years), we are of the opinion that it should not prevent us from deciding now upon the air route pattern. While it is true that many international arrangements must still be concluded, it has not been our policy to delay proceedings with respect to our own carrier authorization until landing rights . . . are firmly in hand. To do so might unnecessarily delay the inauguration of service.

"Of course, it is recognized that United States air carriers cannot operate into or through foreign countries without their permission, obtained through inter-governmental agreements or other appropriate arrangements."

In determining routes to be assigned to each of the three companies, the CAB specified general route areas instead of the usual point-to-point pattern. For example, on its route beyond London to Calcutta, Pan Am is authorized to serve in general countries through which it operates subject to laws of those countries and regulations of the Board. Within the general route areas the CAB established an initial service plan setting forth intermediate and terminal points within the area to which service is contemplated.

The route pattern prescribed limits directly duplicating U. S. air carrier competition to the major gateway points of London and Lisbon. In addition to direct routes to European gateway cities, each air carrier was assigned a general route. The northern route goes to American Export, the central route to TWA and the southern route to Pan American.

The general routes, listing points initially designated for service, follow:

NORTHERN ROUTE—Between the co-terminal points Chicago, Detroit, Washington, Philadelphia, New York and Boston; a point in Newfoundland, a point in Lab-

Lands over 6 tons* on any pinpoint

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The TROJAN HORSE is designed to deliver fighting men wherever needed; built to get large trucks, howitzers and equipment into action faster because they can "come out fighting."

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rador, a point in Greenland, a point in Iceland; Foynes, Eire; Glasgow, Scotland; London, England; Amsterdam, Holland; Copenhagen, Denmark; Stavanger, Norway; Stockholm, Sweden; Berlin, Germany; Warsaw, Poland; Helsinki, Finland; Leningrad, U.S.S.R.; and the terminal point Moscow.

CENTRAL ROUTE—Between the co-terminal points Chicago, Detroit, Washington, Philadelphia, New York and Boston; a point in Newfoundland; the intermediate points Foynes, Eire; London, England; Brussels, Belgium; Prague, Czechoslovakia; Vienna, Austria; Budapest, Hungary; Belgrade, Yugoslavia; Bucharest, Romania; Istanbul, Turkey; Ankara, Turkey; Teheran, Iran; Karachi, India; Calcutta, India.

SOUTHERN ROUTE—(1) Between the co-terminal points Chicago, Detroit, Washington, Philadelphia, New York and Boston; a point in Newfoundland; the intermediate points Foynes, Eire; Paris, France; Berne, Switzerland; Rome, Italy; Athens, Greece; Cairo, Egypt; Jerusalem, Palestine; Basra, Iraq; Dhahran, Saudi Arabia; terminal point, Bombay, India. (2) From the same terminal points in U. S. to Newfoundland, Lisbon, Rome; Algiers, Algeria; Tunis, Tunisia; Tripoli, Libya; Bengasi, Libya, and terminal point, Cairo, Egypt.

The decision granting TWA, American Export and Pan American North Atlantic certificates also denied the applications of Northeast Airlines, Inc., Pennsylvania-Central Airlines Corporation and National Airlines, Inc., for franchises to conduct international operations in these areas. The Board adhered to its policy of keeping airline and steamship operations separate by rejecting the North Atlantic route request of Moore-McCormack Lines, Inc. Applications of two other organizations, Trans-Oceanic Air Lines, Inc., and U. S. Midnight Sun Air Line, Inc., neither of which has air facilities in operation, also were turned down.

The Board's awarding of certificates to TWA and American Export will create the first serious competition for Pan American. Its only peacetime competition from an American company was provided by American Export in operations to Lisbon in late 1940 and in 1941. Pan Am contended before the Board that there will not be sufficient traffic across the North Atlantic to justify the operation of more than one U. S. air carrier and that the traffic will have to be shared with foreign competitors.

The Board's important ruling in the North Atlantic case, which was approved by President Truman, was issued several days after a subcommittee of the Senate Aviation Committee disapproved, by a vote of 7 to 2, the McCarran bill proposing an All-American flag line, or so-called "chosen instrument," to fly internationally. Announcement of the Board's findings was followed immediately by a stormy session of the Senate Commerce Committee whose members refused to report out the McCarran bill to set up a single company to operate U. S. international air commerce. Simultaneously, the McCarran compromise to maintain a distinct cleavage between international and domestic air carriers was rejected 10 to 9.

Death of the McCarran bill in committee was preceded by one of the most bitter battles in the history of U. S. civil aviation. The issue it raised was whether the policy of regulated competition should be discarded for a policy that would prevent our domestic carriers from active participation on the world's air trade routes by making them stockholders in a single, Government-controlled company.

Major proponents of the bill were its sponsor in the Senate, and Pan American Airways assisted by United Air Lines. In the other camp, lined up solidly against Pan Am and United and McCarran, was the Airlines Committee for United States Air Policy, representing 17 U. S. air carriers.

If it had become law, the McCarran bill would have superseded the Aeronautics Act of 1938 and created the All-American Flag Line, Inc., a federally-chartered private corporation, with each U. S. air carrier eligible to subscribe to its capital stock.

The bill proposed a Class A stock issue of $200,000,000, with no limit on the amount of Class B stock. Only Class A stock would be voted at stockholders' meetings. Any air carrier holding certificates issued by the CAB would be eligible to purchase Class A stock but no Class A holder could buy less than $5,000,000. Maximum Class A stock holding would be $50,000,000.

If any carrier eligible failed to subscribe for the full share of Class A stock to which it was entitled, its share would be re-allocated among the other carriers.

One significant provision of the bill was that before an air carrier could subscribe for Class A stock it would have to agree to sell to the corporation, after it became a stockholder, any of its physical assets, franchises and goodwill used in foreign transportation. Each Class A stockholder would have one representative on the board of directors and 10 additional members would be elected annually by the board.

The bill would have authorized the Secretary of State to negotiate agreements with foreign governments in the name of the United States for the benefit of All-American Flag Line. The Flag line would operate internationally only.

The onslaught of attacks upon the bill began as soon as it was introduced, spearheaded by Alexander B. Royce, chairman of the Airlines Committee. Many of the opposing groups established special offices in Washington to be close to the battle scene. Publicity staffs worked overtime preparing statements or urging publications to take up the cudgels for "our" side.

After Senator McCarran announced at the hearing that the split-up of stock would give Pan Am 25 per cent of the voting stock, the biggest share, some opponents of the bill used it as fuel in a campaign to put across the idea that Pan Am would be the operating company for the Flag Line.

But the designation of one company as the operator was not mentioned in the

DESIGNED to fly at high altitudes, tomorrow's planes will climb into the sky like homesick angels . . . carrying us literally to the end of the rainbow in comfort and safety. • Pacing this dream with reality, engineers are at this moment perfecting designs for the planes of the future. For example, planes the size of this giant aircraft call for even greater feats of engineering in the field of precision instruments to make certain that they will have the maximum amount of efficiency and safety. • In this connection, Kenyon is proud to play an important role. Since the beginning of the war, Kenyon has designed and delivered *in quantity* and *on time* countless precision instruments for American war planes. • In addition, Kenyon instruments are used in many commercial planes, such as the giant Pan American clipper—renowned for its services in transporting vital personnel and cargo during the war. • In peace as in war, Kenyon's engineering staff is at the service of American aviation—in the development of dependable *precision* instruments, from the *basic design to the completed product.*

KENYON

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DESIGNERS OF BETTER PRECISION PARTS FOR THE AMERICAN AVIATION INDUSTRY

bill. Since the bill proposed a pooling of all air carriers' resources in the interest of a strong U. S. flag line, it was assumed that the board of directors would pool the most able men of all lines for actual operating duties.

Juan Trippe, president of Pan American, a vigorous leader in the fight for a united effort in the international air field, believed it absurd to divide American strength by permitting competition among a multiplicity of American-flag lines. Such an attempt to divide the available Atlantic traffic, he said, would weaken the American effort so that it could not hope to compete against international air monopolies created by other nations.

He fought a losing battle and his cause was opposed from every side. Newspapers, in editorials and syndicated columns, were overwhelmingly against the proposed Flag line, as were a majority of the nation's military leaders.

Secretary Stimson, in a letter to the Senate Commerce Committee, declared the McCarran bill "represents a radical departure from, if indeed not a complete reversal of, our existing national policy."

Charles Fahy, acting Attorney General, said: "It seems likely that the enactment of this legislation might not give the United States progressive development in the field of international air commerce, since I believe it would tend to stifle competition."

H. Struve Hensel, Acting Secretary of the Navy, said: "In the opinion of the Navy Department, the one-company proposal would not provide the competition between the United States air carriers which is deemed to be desirable."

W. L. Clayton, Assistant Secretary of State, said: "I think the conclusion is inevitable, therefore, that any airline assured of a monopoly of international air transport under the American flag would, by force of circumstance and following the ample precedents which exist, sooner or later conform to this pattern of Government ownership".

David L. Behncke, president Air Line Pilots Association, said: "The establishment of a monopoly in the United States overseas intercontinental air line transportation would commit (airline employes) to an economic serfdom."

W. A. Patterson, president United Air Lines, said: "I don't think that I could endorse the detail of Senator McCarran's bill, but I do think that it presents a theory and a philosophy with which I am in complete agreement and, as everyone knows, I believe very strongly that the only way for us to compete with foreign carriers is through a chosen instrument."

But the chosen instrument is now ruled out and three U. S. airlines will soon be flying to Europe and points east. With this precedent established, future decisions of the Civil Aeronautics Board, in important international cases still pending, can be expected to follow the same pattern. From now on, regulated competition is almost certain to be the predominant theme of our international air commerce. END

Salvaging Our Surplus Warplanes—in Canada

(*Continued from page 44*)

planes, which range all the way from elementary trainers to twin-engined flying boats, can only be purchased through direct application to WAC.

By May 30, 1945, some 400 of these planes had been sold—they brought $1,390,000. All were airworthy craft except one small lot of elementary trainers purchased for the establishment of spare-parts stocks. Totals sold by types were 11 Lockheed transports, 18 Anson twin-engined trainers, three De Havilland *Tiger Moth* elementary trainers, 10 Grumman *Goose* amphibians, 18 Stinson transports, 53 Fairchild *Cornell* elementary trainers, two Beechcraft transports, eight Cessna *Crane* twin-engined trainers, three De Havilland *Dragonfly* trainers, three Oxford trainers, seven *Hudson* bombers (to be used as transports), 21 *Stranraer* twin-engined flying boats (to be used as transports), four Noorduyn *Norseman* transports, 189 Fleet *Finch* elementary trainers, and one Fleet *Freighter*. Of this number, 284 aircraft were sold for use outside Canada, principally to South America. In addition, WAC has sold (from its inception up to May 30, 1945) $1,000,000 worth of aircraft components and engines.

About once a month, sometimes less frequently, WAC issues a list of surplus aircraft for sale. Unless so marked, these planes carry certificates of airworthiness from the Canadian government. The lists issued by WAC do not quote prices; they merely show what is available. Any person may obtain such lists by writing in for them. Those interested in any particular lot or in single planes offered for sale can then determine from WAC what that aircraft or equipment will cost.

It is a principle of WAC operation that all sales of war surplus equipment must be handled through regular trade channels. Auction sales are taboo, and the industry must be consulted in arriving at a suitable price for each article.

The aircraft division of WAC consults with the Canadian industry through the Air Industries and Transport Association to set a price on each aircraft type. After a price is set, in some cases about one-quarter of the price of the aircraft when new, it is again adjusted with relation to hours of flying time and number of overhauls the plane has sustained. A graphic curve has been developed for fixing prices on various lightplanes and small transport types. The availability of spare parts is taken into consideration when arriving at a price—aircraft for which there are substantial stocks of spares bring a better price than an aircraft for which supplies are limited, both airplanes being in the same condition.

Hours of service, overhaul, the complete history of individual aircraft is taken into consideration in fixing prices on larger transport-type aircraft not made in Canada. Four years of post-war service is generally assumed to be a maximum for these aircraft. But sometimes the individual history of an aircraft may result in its being sold without reference to any price or utility formulas. One aircraft apparently jinxed by mechanical difficulties was sold cheap outside Canada because Canadians acquainted with its story would not touch it. Strangely enough, the plane was flown away without difficulty and has been in service as a transport ever since.

Combat-type aircraft are handled by WAC on the premise that modification

"Know what I'm going to do this fall, Bill?"

"I'm going to be an airplane mechanic," Jack told Bill. "You know, a guy who services planes and is able to make complete overhauls. Every aviation station must have 'em. Now I want to get an airplane mechanic's **license**, 'cause **licensed** mechanics are preferred."

"Where are you going to get your training?"

Jack answered, "Roosevelt Aviation School."

"Hold the phone, boy. I've heard of that school before. Jim's brother, who was discharged from the Army Air Corps last month, is training there under the G.I. Bill to get his **license**. But what if you're drafted?"

"Then my **license** will put me in line for a better rating in the service. If Uncle Sam doesn't need me, I can get a good job in commercial aviation," Jack said.

"I think I'll have a look see, too," Bill told Jack. "We may be studying mechanics **together** this fall!"

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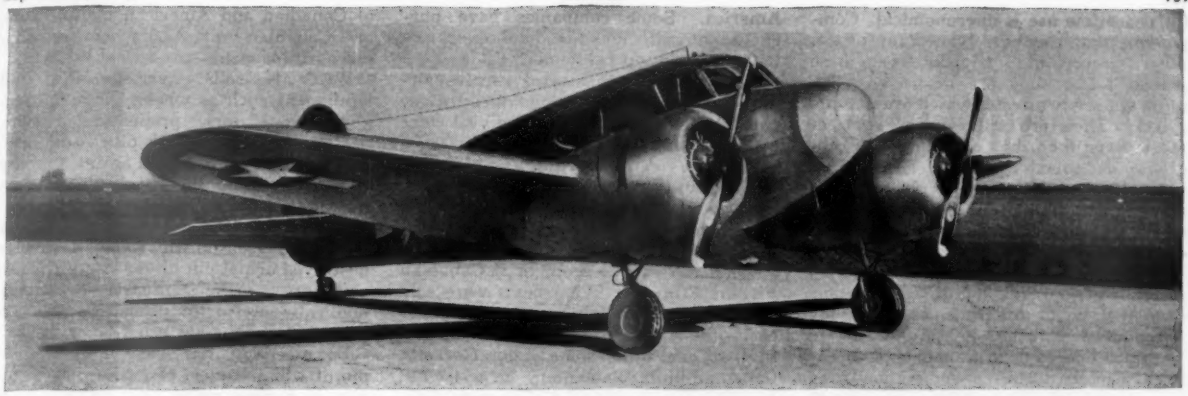

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This aircraft is a low-wing monoplane of composite wood, steel and fabric construction and is powered with two Jacobs Model L4MB engines, of 225 horsepower each. These Army models, designated as UC-78 and AT-17 (commercial model T-50), are type-certificated but individual planes must be repaired and modified to meet Civil Aeronautics Administration airworthiness requirements for civilian flight.

Information concerning sales procedure, location of aircraft, and price, may be obtained from your nearest Sales Center.

PRICE DETERMINATION

Prices for these planes have been set to make allowances toward modifications, repairs and overhaul. The $8500 price is for planes equipped with constant speed propellers, and a wing which is eligible for CAA approval to permit a 5400 pound gross weight. Prices are lower for planes equipped with fixed pitch wood propellers and/or a wing designed for a 5100 pound gross weight.

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(Cities listed alphabetically by States)

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Tucson, Arizona	Ryan
Wickenburg, Arizona	Echeverria
Pine Bluff, Arkansas	Grider
West Helena, Arkansas	Thompson-Robbins
Blythe, California	Gary
Concord, California	Sherman
Fresno, California	Chandler Field
Hemet, California	Ryan
Ontario, California	Cal-Aero
Denver, Colorado	Rutledge
Miami, Florida	Chapman
St. Petersburg, Florida	Ludwig-Sky Harbor
Americus, Georgia	Souther
Augusta, Georgia	Bush
Douglas, Georgia	Municipal
Lansing, Illinois	Ford-Lansing
Indianapolis, Indiana	Sky Harbor
Davenport, Iowa	Cran
Wichita, Kansas	Municipal
Baton Rouge, Louisiana	E. Baton Rouge Parish
North Grafton, Massachusetts	North Grafton
Lansing, Michigan	Capitol City
Minneapolis, Minnesota	Victory
Clarksdale, Mississippi	Fletcher
Madison, Mississippi	Augustine
Cape Girardeau, Missouri	Harris
Kansas City, Missouri	Municipal
Robertson, Missouri	Municipal
Sikeston, Missouri	Harvey Park
Helena, Montana	Municipal
Omaha, Nebraska	Municipal
Reno, Nevada	Reno
Readington, New Jersey	Solberg-Hunterton
Albuquerque, New Mexico	Army Air Field
Albany, New York	Albany
Rochester, New York	Municipal
White Plains, New York	Westchester County
Charlotte, North Carolina	Cannon
Akron, Ohio	Municipal
Cincinnati, Ohio	Lunkin
Muskogee, Oklahoma	Hat Box
Oklahoma City, Oklahoma	Cimarron
Ponca City, Oklahoma	Municipal
Portland, Oregon	Portland-Troutdale
Pittsburgh, Pennsylvania	Bettis
Bennettsville, South Carolina	Palmer
Camden, South Carolina	Woodward
Sioux Falls, South Dakota	Sioux
Jackson, Tennessee	McKellar
Union City, Tennessee	Embry-Riddle
Ballinger, Texas	Bruce
Corsicana, Texas	Corsicana
Cuero, Texas	Municipal
Fort Stockton, Texas	Gibbs
Fort Worth, Texas	Hicks
Houston, Texas	Municipal
Lamesa, Texas	Lamesa
San Antonio, Texas	Municipal
Stamford, Texas	Ariedge
Vernon, Texas	Victory
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16–2

for peacetime use is uneconomical. Components that can be salvaged for use in other aircraft are stripped from these planes before they are destroyed. The same applies to aircraft which are not airworthy. These are stripped of all replacement parts; then they are burned or otherwise destroyed. In some cases WAC has sold a number of airworthy planes and an additional lot of unairworthy craft to the same buyer for use as replacement equipment and parts.

Because private flying is still banned under wartime regulations there have been few WAC aircraft sales to private individuals. Most sales are made to transport operators in Canada and to airlines, aircraft dealers and manufacturing companies in the United States and South America. Some companies have purchased aircraft for sales and executive trips of their top personnel.

WAC reports on sales of surplus aircraft give an indication of typical prices paid: A Grumman *Goose* flying boat went to a Latin American airline for $35,000; a Beechcraft went to an American company for $16,500; Lockheed *Electras* sold for an average of $15,000 each; Fleet *Finches*, Canadian-built elementary trainers, went to a Latin-American buyer for an average of $1,427 each; a group of 21 Canadian Vickers *Stranraer* flying boats were sold for Caribbean freight service at $8,000 each—the largest group of combat aircraft sold at one time; some Fleet *Cornells*, Canadian-built elementary trainers, brought an average of $2,500 each; Stinson transports have been sold at $680 each; Cessna *Cranes* were sold one month at $3,000 each; other aircraft which have been sold include *Hudson* bombers which can be converted to transports, Noorduyn *Norseman* transports built and designed in Canada and used as transports by the USAAF, various elementary trainer types of Canadian and American manufacture, and Canadian-built *Anson* bomber trainers as transports.

WAC also sells a variety of aircraft equipment such as wheels, pontoons, engines, generators, propellers, starters, heaters, magnetos, spark plugs and skis.

WAC policy is to obtain as much money as possible from the surplus equipment for the taxpayers of Canada who paid for the material in the first place. This is given as the reason why some aircraft are destroyed or not put up for sale—it would cost more to make them airworthy or economically useful for peacetime purposes than their sale could bring.

Because WAC has offices in Great Britain, it will sell most of its European surplus in Europe rather than bring it back to Canada for shipment to the Pacific war theater. Combat equipment and aircraft in good shape, however, are being sent on to the Pacific war zone.

Canada has been selling its surplus aircraft and equipment since the latter part of 1944, shortly after WAC was formed by the government. END

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London Letter

(*Continued from page 46*)

perform only slightly better than the venerable DC-3—cruising at 210 m.p.h—but it can be brought quickly into production which is, for Britain, a matter of first importance.

It uses *Wellington* (geodetic) wings, and a *Warwick* tail unit slightly modified. Designer Rex Pierson would have liked to use a tricycle chassis but the need for getting into production at once dictated the ordinary *Wellington* chassis.

Gnats

Flies, gnats and midges can change the shape of the air flow over the wings of a full scale aircraft, according to investigation made at Farnborough, chief British air research establishment. If a modern aircraft with laminar flow wing passes through a cloud of gnats—when taking off, for instance—the boundary layer separation point shifts enough to change the flying characteristics.

The effects were studied by making the wings of a *Kingcobra*—thought to be among the best laminar flow sections—tacky like flypaper and then flying the aircraft through smoke. The indication is that increased emphasis must be placed on surface finish as speeds increase and wing sections improve.

New Chassis

When B. N. Wallis—now a Fellow of the Royal Society, Britain's highest scientific honor—takes out a patent his specification is worth notice. His new chassis is especially interesting.

An essential feature is that it does not use pneumatic tires. On an ordinary retractable oleo leg, a bogie is attached by an ankle joint. The bogie has three pairs of small wheels.

The idea is to transmit the impressed force on landing to the oleo strut and to transform energy into heat. Such conversion or "destruction" of the energy is not possible with a pneumatic tire, which is a "pure spring." A saving in weight, the elimination of the risk of bouncing on landing, and superior riding on the ground are advantages claimed.

Turn-Around Time

Information is being collected by a British committee on the subject of aircraft requirements for giving good turn-around time. For small aircraft working short hauls, a turn-around time of 10 minutes has been suggested and for longer stages and larger aircraft one hour.

Liberators on the North Atlantic run take about three hours at Prestwick. Aircraft operators in Britain are criticizing the ground vehicles available for helping in aircraft servicing. Special designs are being prepared.

D.P.R.

Visitors who come to England to take a look at the RAF make contact with the director of public relations at the Air Ministry. The air historian H. A. Jones, who followed Lord Stansgate, held this office till he was killed in an air accident while on his way across the Atlantic.

Air Comm. Lord Willoughby de Broke (pronounced "Brook") has taken his place. Aged 49, he has long been assistant director. He learned to fly nine or 10 years before the war and has owned several personal aircraft. He is a holder of the Military Cross and the Air Force Cross. His family motto—"Virtue Prevails."

Bomber Crew Risks

Casualty percentages for the RAF Bomber Command in Europe fluctuated with the degree of air domination. In 1941 they were 2.5 per cent of the attacking forces; in 1942, four per cent; 1943, 3.7 per cent; 1944, 2.2 per cent; 1945, 1.1 per cent. RAF fatal casualties in Europe from August 1, 1943, to April 30, 1945,

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were 20,336; 65 per cent of these deaths were among Bomber Command aircrew members.

Pole Jumping

There is dispute about the location of the magnetic north pole. First assessment of the information brought back by the *Lancaster "Aries"* after its polar flights show the magnetic north pole to be 200 to 300 miles away from the point previously supposed. But this has been challenged. Your correspondent is not going to make the trip in order to see.

A Better Hole

Divers are still, at this writing, inspecting the damage to the German battleship *Tirpitz* which was sunk with 12,000-pound armor-piercing bombs dropped from *Lancasters*. One hole in her side is 130 feet long.

As I Saw It

(*Continued from page* 49)

England from Washington, D.C., aboard an Air Transport Command *Skymaster* (C-54) in 10 hr. 54 min., making one stop at Stephenville, Newfoundland. In England a *Skytrain* (C-53) was assigned to our party and it has carried us all over Germany. Our pilot is Lieut. Emmet M. Bridewell of Visalia, Calif.; co-pilot is Lieut. Robert G. Seymour of Buffalo, N. Y..; engineer, M/Sgt. Paul E. Carlson, Chicago City, Minn.; radio operator, Pvt. Anthony J. Leotta, Brooklyn, N. Y.

We flew from London directly into Germany, basing in Hamburg and travelling to various sites during the day, returning there at night. After covering most of Northern Germany we flew down to Munich, less than 100 miles from Italy, where we now are based while covering southern Germany.

We have seen bomb damage that defies description—the work of the United States 8th and 9th air forces and Britain's Royal Air Force. We have seen bombed shipping; 42 large ships were sunk or burned-out in Hamburg's harbor alone. We have seen airfields that have been bombed almost beyond recognition. Hundreds of German aircraft were caught on the ground by fighter-bombers and, despite the most elaborate efforts to conceal them in forests, barns or haystacks, they were wrecked by strafing and bombing.

I have been able to inspect several interesting types of German aircraft. One of the most interesting is the Dornier Do-335, an unorthodox, twin-engined fighter-bomber that was undergoing flight tests when the war ended. It never saw combat. It has one liquid-cooled engine in the nose with the conventional tractor propeller. The second engine is at the rear of the fuselage, with the pusher propeller in the extreme tail, behind the rudders and elevator. It has tricycle landing gear and a fairly large bomb compartment.

Other aircraft I inspected include the Messerschmitt Me-262, the staple jet fighter of the German air force; the newer twin-jet Arado Ar-234; nearly all of the standard air force types, such as the Focke-Wulf Fw-190, and Fw-390, Junkers Ju-88 and Ju-188, Heinkel He-177; and a tiny unidentified, single-place high-wing monoplane with no visible power plant. It appears to have been designed for a removable jet or rocket power unit, and has at least two cannon in the nose.

At the Blohm & Voss factory at Hamburg I saw another unusual airplane designed for the German air force. It is the Bv-155, a high-altitude interceptor with pressurized cockpit. Its design was based on the assumption that the AAF would soon be sending its bombers over at 39,400 feet. The Bv-155 is powered with a 2,000-h.p., liquid-cooled engine fitted with a turbosupercharger. Top speed was said to be 450 m.p.h. at 49,000 feet. Its range is about 1,250 miles, and it carries up to five 30-mm. cannon.

Following the visit to the Blohm & Voss factory, I had the opportunity to talk with Dr. Richard Vogt, the company's chief aircraft designer and the man largely responsible for the six-engined Bv-222 flying boat used by the German air force. He also designed the 90-ton giant, Bv-238, a fuselage of which was found standing in the Blohm & Voss factory. Wing span is 196.85 feet, range nearly 6,000 miles. It has six 2,000-h.p. engines. One Bv-238 was completed and flown in 1943, Dr. Vogt said, but production plans were dropped after a conference in Berlin with Col. Gen. Ehrhard Milch, deputy chief of the German air force.

"In explaining his reason for abandoning the Bv-238," Dr. Vogt said, "Milch said 'The house is burning and we must put out the fire first.' He was referring, of course, to the fact that Allied air attacks were so heavy that it was necessary for us to turn all our attention to the production of fighters."

The only Bv-238 in existence then was taken to Lake Schaal near Hamburg and hidden under camouflage; raids on Hamburg threatened to destroy the six-engined giant. It remained intact until within two weeks of the end of the war. Then one day six patrolling AAF *Mustangs* spotted the big camouflaged flying boat and strafed it until it sank.

Dr. Vogt also described a tiny glider bomb I saw at his factory. Designated the Bv-246, it is a 1,653-pound bomb with plastic-covered steel wings, a gliding ratio of 25 to 1. Its glide speed at 7,000 feet was said to be 350 m.p.h. According to Dr. Vogt, it was to be used against British cities, being dropped from any type of German aircraft, including the smallest fighters. It later was planned to be a target for antiaircraft rockets with which Germans were experimenting.

During our interview I asked Dr. Vogt what American warplane he thought was best. His answer was immediate: "Aerodynamically, the *Mustang*. But I also have great respect for the *Thunderbolt*. It is one of the most rugged and versatile airplanes I have ever seen."

Dr. Vogt also said that, in many respects, American aeronautical engineering has been ahead of that of the Germans. He cited the NACA-designed laminar-

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"We tested such a wing, which we got from a captured *Mustang*, in a wind tunnel alongside a Messerschmitt Me-109 wing," Dr. Vogt said. "Frankly, I must say that the performance and efficiency of the *Mustang* wing could not be compared with the Messerschmitt wing."

I asked Dr. Vogt what he was working on as the war ended. "We had just started work on a jet-propelled design when the war ended," he said, "and our next airplane project was to have been a three-place twin-jet night fighter weighing 13,230 pounds. After the war I had hoped to build a 200-ton flying boat powered with eight 4,000-h.p. engines."

When questioned about the Allied bombing tactics he had seen, Dr. Vogt said:

"I feel that the precision pin-point bombing of the American air forces got better results strategically and more humanely than the area bombing of the RAF. If the entire weight of bombs dropped on Germany had been dropped precisely on the pin-point targets, I think the war would have ended sooner than it did." END

Report from Washington

(*Continued from page 43*)

reach velocities in excess of 150 m.p.h. Best B-29 time yet recorded on the 1,500-mile route from Japan to Saipan is said to be three hours. With a record in mind, the pilot of that plane climbed to high altitude and found a 200-mile tail wind. The wind and the plane's speed (it can attain 350 m.p.h.-plus at maximum power) did the trick.

Touring NACA

Correspondents who visited the NACA Aircraft Engine Research Laboratory in Cleveland early in June—the first such tour, incidentally—came away with a new appreciation of the engineering mind. Wholly apart from the sensational research work underway there, they were amazed by the efficiency with which the tour was organized and conducted by the engineers. The demonstrations were graphic, simple and instructive. The group visited successive laboratories on perfectly-timed schedules and were shown the works. No single demonstration lasted more than a few minutes, but every one got its points over thoroughly. Public relations men can take a lesson from the good engineers of NACA.

Water Injection

The CAA has made a necessary change in the regulations to cover the certification of aircraft engines equipped with water injection. Every such engine for post-war commercial operation must have two CAA take-off ratings, one with and one without water. First engine to be certificated with water is the Pratt & Whitney R-2800-C, but its ratings are on the restricted list. However, the difference between the two figures is remarkable. CAA has not yet been requested to certify the Wright 3350 which has been undergoing water tests for some time and probably will be checked out by CAA at substantially higher ratings than the 2800-C.

The higher take-off power of such engines will be important to aircraft manufacturers and, of course, to air carriers, because it will permit higher design load factors. CAA is careful to point out, whenever water injection is mentioned, that current Civil Air Regulations do not sanction emergency ratings or even the evaluation of aircraft performance with emergency power.

A. A. Vollmecke, chief of the aircraft engineering division of CAA, points out that ratings with water injection will be granted provided they are established in accordance with CAR 13, covering engine airworthiness. They provide two ratings, take-off, and maximum except take-off. "It is entirely feasible to establish such ratings with and/or without water injection," explains Vollmecke. "Once such bona fide ratings are substantiated, engine operation at those ratings may be used in the evaluation of future aircraft performance."

Aircraft Manufacturing

American aircraft manufacturers have built 296,139 airplanes of all types since 1939, the peak production year being 1944 when 96,369 were turned out. It is estimated that 85,250 planes will be made this year and that figure would place the total for the period 1939 through 1945 at 342,955 planes. The value of planes produced from 1939 through 1944 was $36,444,000,000. Average monthly output per employe in the airframe industry rose from 21 pounds in January, 1941, to 96 pounds in August, 1944. Average airframe weight climbed from 2,267 pounds in 1940 to 10,019 pounds in 1944.

Latest figures place British aircraft production at 102,609 for the period September, 1939, through June, 1944. In 1943, when American manufacturers built 85,946 planes, the British producers reached their highest level, 26,263 planes. The rate of British production attained in the first half of 1944 indicated the total for that year would be close to 30,000.

Cutback Blues

The production cutback order left North American Aviation hanging on the ropes. Dutch Kindelberger outbid Lockheed on the *Shooting Star* contract and he and his engineers rolled up their sleeves and set out to redesign the plane for speedier production. The first plane was 40 per cent complete, with the Dallas plant tooling program 90 per cent complete, when the cutback hit on May 25. Consequently, North American will not produce a single P-80. As for the Fairchild *Packet*, North American will build only 20 of them. Also, the company's original order for 500 twin-engined fighters has been reduced to 20. North American is making the P-51H and that's about all;

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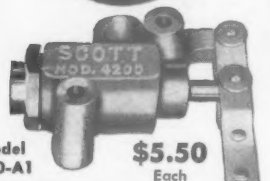

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Briefings

After a lapse of many years, Curtiss-Wright is back in the Navy fighter plane field with an experimental job that may be the company's first production model of that type for the Navy since the late 1920's. It is not yet in production. Immediate predecessor of the current Curtiss-Wright fighter was an experimental single-engined, inverted gull wing fighter not planned as a production model . . .

The *Seawolf* being built at Consolidated's Allentown, Pa., plant is said to be more maneuverable and much faster than other torpedo bombers. The eight-ton plane began life as the Chance Vought XTBU-1, a four-man airplane. It has been modified to accommodate a pilot and crew of two . . .

The number of military airplanes of all types in service in continental United States and foreign areas was 100,574 on July 1, 1945. Of that number, 61,000 are Army and 39,574 are Navy planes. The figures do not include about 6,000 Army planes now in storage but soon to be declared surplus. END

I Learned About Flying from That

(*Continued from page 74*)

right, but the plane resembled a junk pile.

I posted two farmers who had run up to the plane to guard it and then I went to the hospital. After being patched up I telephoned my C. O. and gave him all the details. He said he would have me picked up the next day. It was with the arrival of my rescuers that I was *really* fixed up. I was sitting under the wing, keeping out of the hot August sun, when they arrived. An enlisted man crawled into the cockpit and attempted to radio Shaw Field but couldn't get any response. This didn't surprise me a bit—the ignition was still turned off. I told him he would have to turn the ignition on in order for the radio to operate. As he turned the ignition switch on, the plane blew up! The explosion was caused by the many short circuits in the plane which ignited the gasoline vapors. There I was, under the wing tanks, a sorry looking mess. And for the second time I was taken to the hospital, where I remained this time for a month. I suffered second degree burns of the face, arms and back. When my wife visited me in the hospital, she gasped at the sight of me and said, "You look just like a mummy—a bald-headed one at that." My head resembled a cue ball since almost all my hair had been burned off.

After escaping serious injury in my crash landing, something like that had to happen to me. I certainly turned out to be a "hot pilot," one, who from that day's events says: I learned about flying from that. END

"Just think, if it weren't for the war we'd both be through high school by now."

FLYING

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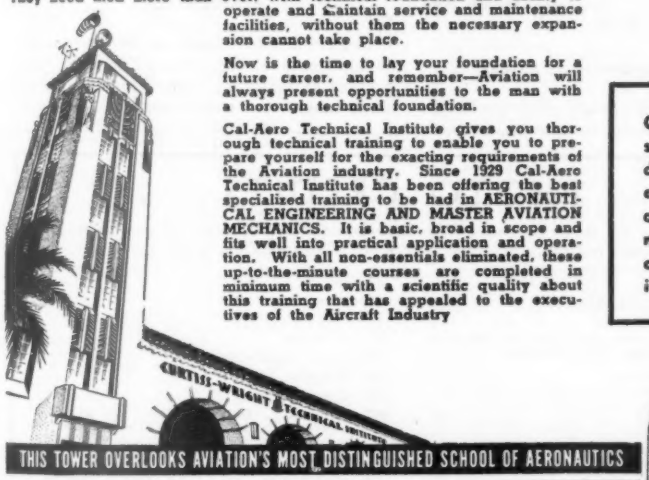

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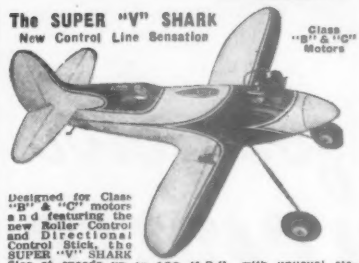

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Where Would You Land?

(*Continued from page 42*)

Learn to read terrain from all altitudes. Dark fields ordinarily are highly cultivated and should be avoided. Grass lands have a matted appearance, with the grass highest in July. Orchards appear as plots of evenly-placed dots. Plowing gives a field a squared or rectangular appearance and vegetation changes bordering open fields may indicate fences which are difficult to see if kept clean.

When flying in early morning or late afternoon, shadows are longest, accentuating buildings, trees, hedges, mountains, hills and fences. Shadows will reveal the relief of any object viewed from a vertical position at these times, giving good indications of its length and height.

While each forced landing has individual circumstances that make generalization difficult, certain procedures are necessary to effect safe landings in a majority of instances.

Don't turn down-wind, except to get in the proper base leg position. And *don't* head for the first field you see. Look out both sides of the plane, pick the best field within range, plan your pattern into it and—*don't change your mind.*

Above all, keep your head. A rattled pilot can easily misjudge distance and drift, ruining what might have been a perfect pattern into an easy landing field. Many hangar arguments take place as to whether the pilot should concern himself with washing out the plane in a forced landing. It is well to remember that if you save the airplane you save yourself. END

Letters

(*Continued from page 76*)

logged as instructor, 200 dive-bombing, 300 on carriers, 1,900 on cross country and 300 in gunnery instruction.—ED.

EVEN JERRY LIKED THEM

Sirs:

I thought you might be interested in knowing that when I was with the 9th U. S. Army Air Intelligence I found among captured German aerial documents, some of the cutaways featured in your publication.

G. W. BECWAR

APO, New York, N. Y.

GROUND INSTRUCTOR'S FUTURE

Sirs:

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F. M. JORGENSEN

Salt Lake City, Utah

● Perhaps the simplified regulations will attract so many new people to flying who will voluntarily want to know these things that Reader Jorgenson's business will be increased many fold—ED.

ENGINE ERROR

Sirs:

In FLYING's July issue, a caption in Joan David's article, "Air Force For Sale," describes students as "installing a cylinder on a single-row radial engine." I say it

(*Continued on page 148*)

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(*Continued from page 146*)

is a P. & W. R-2800—a twin-row *Wasp*. No other engine has the type of assembly for reduction gear coupling and secondary counterbalance assembly shown in the picture. Am I right?

C. R. HESSE, AMM 2/c, USNR

Chicago, Ill.

● Reader Hesse is correct, it is a twin-row engine.—ED.

"L" PILOT QUALIFICATIONS

Sirs:

So the CAA says the extensive training of regular AAF pilots gives them the edge when it comes to awarding CAA commercial licenses? Both the L Pilot and the regular AAF pilot have about 200 hours when they get their wings. But the L pilot's time has been spent in navigation, short field landings and take-off's, whereas the other pilot spends much of this time on formation flying and gunnery.

I ask you—which of the two would be best qualified for a commercial ticket with a O-300-h.p. rating?

S/SGT. KELLY FEYEN

APO, New York, N. Y.

● Under the new CAA regulations, horsepower ratings are no longer used. We believe all L pilots will easily qualify for a commercial license post-war.—ED.

FORTRESS NOSTALGIA

Sirs:

FLYING's May issue shows a picture of a seven-plane *Fortress* group forming over England to begin a continent mission. This is my old group and the picture brought back a lot of memories.

LIEUT. H. E. RICHARDS

Houston, Tex.

Sirs:

. . . The beautiful colored photo of the *Forts* in the May issue shows some planes particularly familiar to me, since I've flown all of them.

LIEUT. JOHN P. WEIDENBACH

Arcadia, Fla.

Sirs:

. . . Old *Sleepy Time Gal* was one of my planes. I spotted her in the picture through the number 112 and the inset triangle on the horizontal stabilizer. She was a honey of a plane.

LIEUT. K. F. BAILEY

Manitou Springs, Colo.

Sirs:

Those *Forts* are all familiar to me; I was wounded on a mission in *Sleepy Time Gal*.

T/SGT. JOHN A. DUFEK

Santa Ana, Calif.

Sirs:

. . . I put in six of my 30 combat missions in the plane in the foreground, *Sleepy Time Gal*.

LIEUT. WM. H. SHERBURN

Alamogordo, N. M.

Sirs:

. . . That plane in the foreground, *Sleepy Time Gal* is the very one that flew me home.

S/SGT. THOMAS KOWALCKY

Worcester, Mass.

END